International Journal of Horticultural Science 2007, 13 (2): 45–48
Agroinform Publishing House, Budapest, Printed in Hungary
ISSN 1585-0404

Sweetcorn production from transplants

Orosz, F. & Slezák, K.

Corvinus University of Budapest, Faculty of Horticultural Science, Department of Vegetable- and Mushroom Growing, H-1118 Budapest, Ménesi u. 44

Summary: In our trial we tried to find out how the time of propagation and transplanting influenced the growing season of sweet corn along with some major properties relevant to quality. The following technological variations were compared with the help of the variety Spirit (normal sweet, very early ripening): transplanted plants with floating row cover (with 2 planting dates); transplanted plants with no row cover; direct seeded plants with no row cover. The 21 day transplant growing period reduced the growing period by 16 to 20 days, compared to the technology used in the existing practice of production. Earliness had a negative influence on ear size, nonetheless it is worth while to attempt since the market is not so exacting with new products in the early period. Covering the seedlings in the early season was clearly beneficial, as the floating row cover provided protection for plants against lower night temperatures which are common in this period.

Key words: growing season, earliness, propagation method, propagation time

Introduction

Currently, Hungary is not considered as an influential country of the market considering the majority of the vegetables. The only exception is the sweet corn. Based on its present growing area, the sweet corn is the vegetable which is grown on the greatest area in Hungary and after the sudden and sharp decline in 2003 this plant returned in a rise after 2006. With a growing area of over 30,000 hectares Hungary is presently the first in the EU (*Tömpe,* 2006). Production is mostly carried out in accordance with the demands of the processing factories and foreign buyers in the framework of the so-called systems of production on order. The exact timing, which is based on the knowledge of the growing period of the cropped variety, is an essential element in production for ensuring an adequate product quality and for making good use of processing capacities.

Production is dominated by US hybrids, the growing periods of which are given by the breeding companies, generally expressed in units of heat sum or in days. Hungarian production experiences, on the other hand, suggest that, partly due to the special climatic characteristics of the Carpathian Basin, partly due to smaller or greater differences in the elements of the production technology (habitat, fertilization system, irrigation), the growing periods of the varieties may differ from the values offered. This represents a problem in the scheduling of harvest which is often a threat to product quality.

The abovementioned recession affected not only Hungary but also the holdings of the USA and Western Europe. In the case of the former, however, the increase in fresh consumption partly counterbalanced the rate of decrease. In order to promote fresh consumption, as well as to maintain and increase the sweet corn exports, it is necessary to promote investigations so as to be able to ensure a further increase in the growing area and yields of sweet corn with the help of the experiences.

Of the production technology elements, a number of researchers studied or are currently studying the sowing time of sweet corn. As early as in the beginning of the 20th century some researchers (*Cserháti,* 1901) highlighted the importance of the sowing date. Ripening can occur earlier when sowing earlier and using high quality seeds, as compared to normal or late sowing. *I'só* (1969) and *Pásztor* (1966), after their multi-year sowing date trial, concluded the following: in the case of an earlier sowing seed germination will be more protracted, but from the point of view of ear ripening it was more favourable than late sowing. The greatest influence on early corn development is exerted by moisture and temperature, therefore the authors recommended the early sowing on lighter soils. Early sowing is also recommended by *Aldrich* (1970) for the reason that this way the roots will penetrate deeper, from where they can get water even in periods of drought and the more intensive vegetative growth also takes place during the period of shorter daytime and this way the plants will be smaller and will be less prone to lodge.

Efforts have been made to shorten the growing period by preliminary seed germination. *Long* (1998) used the multigerm treatment, applied by the French with winter wheat, in the case of sweetcorn, by means of which the treated seeds emerged in 3 days (at a soil temperature of 10 °C) while the untreated ones in 7 to 10 days.

According to another solution in use, the seeds are sown in 10 to 14 cm deep seed trenches and the latter are covered with plastic film. The cover is removed 22 to 24 days after sowing. This produces a 4–6 day earliness in emergence and 8 to 10 day advantage in growth and development (*Hodossi & Kovács*, 1996).

The most widespread method is the use seedlings grown in soil blocks (*Pereczes*, 1999) which can also significantly increase earliness. According to the trials of *Kurucz* (1998), seedling growing advanced harvest by 2 weeks. According to *Hodossi* (2004), 10 to 12 day earliness can be achieved by planting seedlings grown in soil blocks and 6 to 8 day earliness by seedlings grown in trays. The measurements of *Anonymous* (1990) showed that the ears of direct seeded corn plants under floating row cover could be harvested 10 days earlier, compared to the plots planted with seedlings and having no cover.

The combined application of seedling growing and floating row cover can advance harvest by three weeks as compared to the traditional technology and can give farmers a three to four times greater income (*Kurucz* 1998; *Pereczes* 1999).

Materials and methods

The experiments were set up in the year 2006 on an area equipped for irrigation at the Experimental Farm of the Faculty of Horticulture of the Corvinus University of Budapest. The results of the analysis of the soil sample collected from the trial area prior to direct seeding are contained in *Table 1*.

Table 1 Soil analysis results

pH_{H_2O}	8.03
Salt %	0.035
Humus %	1.31
K_A	<30
P_2O_5 mg/kg	293
K_2O mg/kg	205
$CaCO_3$ %	<1

The test variety was Spirit, a normal sweet corn with a very early growing period (85 days) and yellow kernels. The owner of the variety is the Syngenta. Average plant height is 159 cm, ear height is 37 cm. Average ear length was 19.6 cm in the variety comparison trials carried out by the National Institute for Agricultural Quality Control and average ear weight was 245 g (*Kovács*, 2002). Heat sum requirements according to the variety owner is 780°C.

The following treatments were applied during the experiment

P1 = covered plants grown from transplants (Apr 6th)
P2 = uncovered plants grown from transplants (Apr 20th)
P3 = covered plants grown from transplants (Apr 20th)
P4 = uncovered direct seeding (Apr 20th) (Control)

For the purpose of seedling growing, the seeds were sown on March 16th and March 30th in trays with rigid walls. For growing the seedlings we used a commercial mix made of white peat 10–20 mm, PG Mix 1 kg/m^3 + micro nutrients, bentonite 40 kg/m^3, pH 5.5–6.5. The seedlings were grown for 3 weeks in both cases and were planted out at the 3 to 4 leaf phenological stage. At the two propagation times the treatments P1 and P3 were covered with Novagryl floating row cover, having a weight of 19 g/m^2, (using the small tunnel technique) in order to enhance earliness. The floating row cover was removed on May 16th.

The cornstand was created to contain 60,607 plants per hectare, according to the recommendations of the owner of the variety, at a spacing of 110+40x22 cm in twin rows. Each plot had an area of 6x7 m (8 parallel rows and 30 seeds sown in each row). The edge was the outer twin rows of the 4 twin rows of the plot. Number of repeats: 4.

Fertilization was done by top dressing with N. No farmyard manure was applied.

In the application of the N top dressing rates (34% ammonium nitrate) we were careful not to apply an active ingredient dose of over 50 kg/ha in order to prevent salt damage. The area received one herbicide application (May 5th, at a dose of Clio 0.15 l/ha+Stomp 3.3 l/ha+Dash 1.1 l/ha) and one mechanical weed control treatment (June 12th). A pesticide application took place on May 23rd, using Decis (0.15 l/ha). The harvest was carried out in two passes.

During the experiment, we studied plant growth rates and recorded the time of the occurrence of the major phenological stages. For this purpose, we carried out regular observations (every 3 to 5 days) according to the following:

- appearance of tassels (in 50% of the plants)
- beginning of tasseling (pollen shed has begun on the axes of tassels)
- 50% female flowering (silks have reached a length of 2 cm on half of the ears)
- milk stage (harvest)

During harvest the ears, together with the husks, were collected from the two central twin rows. After that, 20 ears of average appearance were selected from each row and the following measurements were carried out:

- unhusked ear weight (grams)
- total length (cm)

The statistical analysis of the results was carried out by using the programme MiniStat 3.3. When the standard deviations were identical the mean values were compared by pairs using the Tukey-Kramer test, while in the case of the non identical standard deviations the means were compared using the Games-Howell test (*Vargha*, 2000).

Results and Discussion

The occurrence of the different phenological stages is illustrated by *Figure 1*:

It can be seen that tassel appearance occurred 11 days later in the case of the earlier transplanted (covered) treatment P1, as compared to the tassels of the treatments P2 and P3 which were planted later, i.e. at better weather conditions. Despite the fact that the treatment P2 was uncovered and the treatment P3 was covered, plant cover was

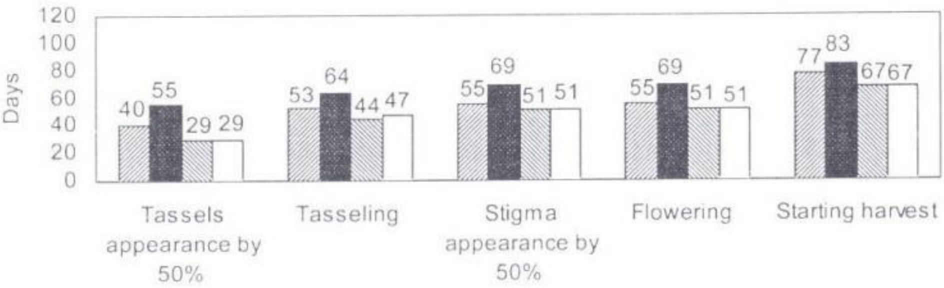

Figure 1 Day of occurrence of generative phenophases (day of direct seeding or transplanting = 0)

ineffective from the point of the occurrence of tasseling. In the case of male flowering, this phenophase occurred 13 days later in the P1 treatment corns, as compared to what was seen in the case of the treatments P2 and P3. A small 3 day difference was found between the treatments P2 and P3 which can probably be explained by the time of data recording.

The protracted occurrence of silking and female flowering in the treatments P2 and P3, as compared to the treatment P1, can probably be ascribed to the fact that a short wave of cool arriving then kept somewhat back the dynamically developing corn plants.

As a result of the steadily favourable weather conditions after the middle of June, the plants of the treatments P2 and P3 reached the state of commercial maturity, i.e. the milk stage and became this way ready for harvest.

The absolute growing season (measured in days) was the shortest in the treatments P2 and P3, merely 67 days, i.e. the corns became ready for harvest 18 days earlier than those of P4 (control), which were propagated at a time, around Apr 20th, and in a way according to the existing practice of production (by direct seeding).

Though the absolute growing season measured in days was 10 days longer (77 days) in the treatment P1, of early planting and provided with floating row cover, as compared to the treatments P2 and P3, at the same time, as planting was carried out 14 days earlier, the result was that it was the cobs from these corn plants that we managed to put first on the market.

The growing season, expressed in days, of the treatment P4 (control) which was propagated according to the existing practice of production, was in accordance with the data recorded by the National Institute for Agricultural Quality Control, which in our case meant that the beginning of harvest was delayed by 20 days, when compared to the treatment P1 and by 16 days when compared to the treatments P2 and P3.

The unhusked ear weight, one of the major yield parameters, is illustrated in *Figure 2*.

Analysing the data measured for unhusked ear yield, we saw that the average weight of the ears of the treatment P1 was significantly (at $p<0.01$ level) lower as compared to the treatments P2 and P3, as well as to the treatment P4 (control).

The greatest average unhusked ear weight was measured with the ears of the control treatment P4, which essentially corresponded to the value in the variety description by the National Institute for Agricultural Quality Control.

Though there was some difference between the plants of the treatments P2 and P3 in unhusked ear weight, statistically this was not significant.

The data concerning, an important characteristics for market appeal (total ear length) are contained in *Figure 3*.

When studying the data relative to total ear weight, we found that the lengths of the direct seeded (control)

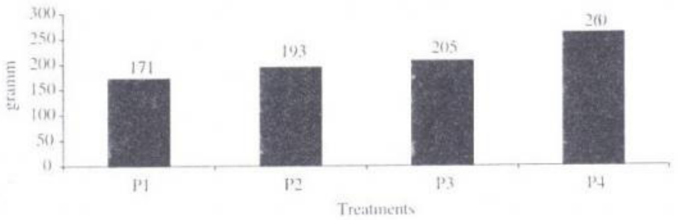

Figure 2 Unhusked ear weight

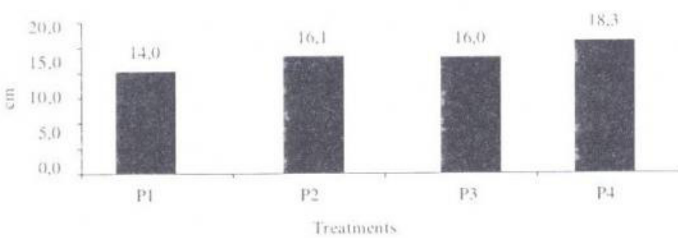

Figure 3 Total ear length.

treatment P4 were also statistically significantly (at $p<0.01$ level) superior to the sizes of the transplanted treatments (P1, P2 and P3).

The length of the earlier transplanted treatment P1 was also significantly (at $p<0.01$ level) inferior to the ear length of the later transplanted treatments (P2 and P3).

No statistically demonstrable difference was found between the ear length of the treatments P2 and P3.

Conclusions

Based on the 2006 year results of the experiments, the following conclusion can be made:

The growing season was significantly reduced in the transplanted treatments compared to the direct seeded (control) treatment. Harvest time occurred 20 days earlier in the case of the treatment of early transplanting and with floating row cover (P1), while 16 days earlier in the case of the treatments of later transplanting and with and without cover (P2 and P3). At the same time the floating row cover did not produce any shortening in the growing season in the treatments P2 and P3.

From the results of the total ear length, which is an important characteristics for market appeal, we concluded that the statistically significantly greatest ears were collected from the direct seeded (control) treatment P4. The average ear length of the early transplanted treatment P1 was significantly inferior compared to the other treatments. There was no significant difference in total ear length between the 2 treatments (P1 and P3) which were transplanted two weeks later.

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