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How Potassium Affects Emergence of Five Supersweet Corn (Zea mays L. var. rugosa) Cultivars with Low Temperatures

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HOW POTASSIUM AFFECTS EMERGENCE OF FIVE SUPERSWEET CORN

(*Zea mays* L. var. *rugosa*) CULTIVARS WITH LOW TEMPERATURE

(TITLE)

BY

Nombasa Tsengwa

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ABSTRACT

Supersweet types of sweet corn (Zea mays L. var rugosa) are sensitive to low temperature during emergence and thus have difficulty in establishing stands in early spring. This study investigated how banded potash affected establishment of five supersweet cultivars of sweet corn in fields and growth chambers.

In the field, sweet corn cultivars were planted near Urbana, Il on April 18 and July 22, 1991 with three levels of potash (0, 45 and 90 kg/ha) banded at planting. Several parameters of growth and development were measured approximately 2, 4 and 6 weeks after planting. No significant effect of potash was found for either planting date or any sampling times except for chlorophyll b during the warm planting at 15 days after planting. Significant cultivar differences were found for several parameters including number of plants emerged, number of leaves, height, fresh weight, dry weight, leaf area, and total chlorophyll at all sampling dates. 'Crisp'n'Sweet', 'Illini Gold' and 'Florida Staysweet' were more tolerant to low temperature than 'Honey'n'Pearl and 'How Sweet It Is'. Soluble solids varied very little at either planting date. Significant interactions between cultivars and potash were observed only for number of plants emerged, number of leaves, height and total chlorophyll at the warmer planting date.

In growth chambers, plants were grown at 15 or 25^{0}C for

15 days with 0, 5 or 10 g potash per tray (6 x 22 x 30 cm). Significant potash effects were found for chlorophyll a at 15^0C and in fresh weight, number of leaves and leaf area at 25^0C. Most cultivars showed increased dry weights, number of leaves, number of plants emerged, heights and leaf areas with 5 g potash as compared to 0 or 10 g although 'How Sweet It Is' showed increased chlorophyll concentration at 10 g potash than at 0 or 5g. Significant cultivar differences occurred, with 'Crisp'n'Sweet, 'Illini Gold' and 'Florida Staysweet' being more tolerant than 'Honey'n'Pearl' and 'How Sweet It Is'. No significant interactions between potash and cultivars were found for either both temperature or either run.

Intermediate potash levels in potassium poor soils may improve stands and development of supersweet corn cultivars.

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CHAPTER 1

INTRODUCTION

In the U.S., sweet corn ranks as the fourth most important fresh vegetable, based on value (Kaukis and Davis, 1986). Approximately one third of the sweet corn is used fresh, although this portion contributes 56% of the value (Lorenz and Maynard, 1988). Traditional types of sweet corn lose their sweetness due to the conversion of sucrose, the sugar responsible for their sweetness, into starch that is not sweet. Due to this conversion, when sweet corn reaches the consumer, sweetness is already lost. Recently, types of sweet corn with high sugar levels which last for a considerable period of time have been developed through plant breeding. Shrunken-2(sh-2) and sugary enhancer (se) are the most utilized new sweet corn endosperms in industry. Because of the high sugar levels in these endosperms, they are referred to as supersweet corn types.

Sweet corn is a warm season crop and low temperature has adverse effects on its germination and emergence, with the supersweet types being more sensitive than traditional types(Swiader and Gerber, 1984). Furthermore, when soils are cold and wet, these supersweet types tend to have poor germination and nonuniform stands, thus posing problems to growers. However, cultivars of supersweet corn grown with similar low temperature conditions differ in tolerance, suggesting genetic differences among germination mechanisms of supersweet corn

cultivars at low temperature. To market sweet corn in early summer, when prices are very high, growers must plant sweet corn in early spring when soils are relatively cold and wet. Soils at this time of the year can be as low as 10^0C and remain low for several weeks (Lorenz and Maynard, 1988; Swiader and Gerber, 1984). This temperature is below minimum germination temperature for sweet corn.

Many cultural practices for sweet corn are used to alleviate problems associated with growth. Practices such as potassium fertilization are used extensively to improve growth on crops. Generally, cell membranes become impermeable under low temperatures with one of the reasons being an inactivation of enzymes by low temperatures. Potassium in interaction with other elements (Mg and Ca) maintains cellular organization, and provides electrical balance, hydration and permeability in plant cells (Mitchell, 1970). In addition, potassium plays a major role as an enzyme activator (i.e. ATPase) or a catalytic entity (Potash and Phosphate Institute, 1978). Therefore, interactions between potassium fertilization and low temperature on germination and emergence of sweet corn require more attention.

The objectives of this study were to 1) investigate the interaction of potassium fertilizer (potash) and low temperature on growth and development of supersweet corn cultivars, 2) to investigate the physiological basis for differences in growth and development, such as chlorophyll

content and potassium content of supersweet corn cultivars during emergence, and 3) to compare results in growth chambers with those in the field plots for objectives 1 and 2.

CHAPTER 2

LITERATURE REVIEW

Sweet corn is a widely accepted vegetable in the U.S. and it is primarily used as a food source (Inglett, 1970). Much improvement of this vegetable has been possible through plant breeding. During the last half of the 18th century, a rapid increase in the development of sweet corn types prevailed (Inglett, 1970). Recently new sweet corn types with different endosperm genotypes compared to those of the old types have been developed. Old types are referred to as traditional sweet corn types with a sugary (su) endosperm while the new types have shrunken-2 (sh-2), sugary enhancer (se), brittle-1, brittle-2 and combinations of amylose extender (dul 1 and waxy) endosperms (Boyer and Shannon, 1983). However, shrunken-2 and sugary enhancer are the most utilized endosperm mutants in industry today. Sugary endosperm has a high percentage of starch and loses its quality rapidly after harvest. This loss of quality from sugary endosperms is due to the conversion of sugars to starch and loss of water (Boyer and Shannon, 1983). In contrast, shrunken-2 and sugary enhancer endosperms contain 1.5 to 3 times more sucrose and moisture at harvest (Basset, 1986 ; Boyer and Shannon, 1983). These new sweet corn types retain their sugars longer than the 3 or 4 days typical of traditional types (Doty, 1980). Hence the high sugar levels in these new endosperms are referred to as supersweet corn types.

Cultivars of supersweet corn germinate poorly at

temperatures below 10^0C (Sabota, Beyl and Bierderman, 1987). To meet demands of early markets, when prices are higher, sweet corn is planted when soils are still cooler around 10^0C. Moreover, low temperature effects on sweet corn result in poor emergence, less seedling vigor and nonuniform stands. Douglass and Juvik (1988) found that mean emergence of traditional sweet corn types was 49% and 57% greater than that observed on supersweet corn types. Various factors are associated with the inferior emergence and vigor observed among supersweet corn types, i.e. the condition of the mother plant, prolonged ear attachment and the rate at which the kernels dry down (Culpepper and Magoon, 1941). Furthermore, since supersweet corn endosperm contain less starch and phytoglycogen, it provides less carbohydrate reserves for optimal rates of seedling emergence and growth (Wann, 1980). During early spring when sweet corn is planted, cold wet soils are prevalent in many areas of sweet corn production, such as Illinois (Cal and Obendorf, 1972). Soil temperatures at the 10 cm depth in Illinois tend to be around 15^0C at this time. Optimum soil temperature for corn depends on the hybrid, stage of growth, depth at which temperature is measured and soil moisture retention (Ketcheson, 1970). Furthermore, optimum soil temperature for corn ranges from 21^0 - 25^0C at a 10 cm depth (Ketcheson, 1970). Several aspects of plant growth are affected by low soil temperatures. The rate of development of the apical meristerm of corn plants while below or close to

or close to the ground, is determined by soil temperature (Iremiren, 1988). Thus soil temperature on maize growth and yield determines the rate of development of the apical meristerm, suggesting that the early age of the corn plant is the most affected stage by low temperature. Low temperature does not necessarily reduce percent survival, but delays germination (Cal and Obendorf, 1972). Also, low temperatures (8^0-12^0C) retard physiological activities of the germinating seeds, thus delaying germination and emergence of the plant (MacLean and Donovan, 1973; Rush and Neal, 1950). Retardation of germination at low temperatures predisposes seeds to an attack by soil organisms (Pinnell, 1949; Rush and Neal, 1950). Main pathogens involved are Pythium species (Ho, 1977; Hoppe and Middleton, 1950). Growth of corn at low temperatures such as 10^0-15^0C is decreased compared to higher temperatures above 16C (Cal and Obendorf, 1972; MacLean and Donovan, 1973). This decrease of growth in plants may be indicated by a decrease in growth parameters, such as leaf area, leaf number, yields, plant height, % emergence, chlorophyll content, fresh weight and dry weight (Cal and Obendorf, 1972; Knoll, Brady and Lathwell, 1964). The increase in plant growth at high temperatures may be attributed to an increase in ion absorption, diffusion rates, reaction velocities, solubility synthesis and translocation (Mederski and Jones, 1963). This effect on ion absorption further suggests that cold temperatures delay rates of plant development (Hortik and

Arnold, 1965). Soil temperature or root zone temperature as opposed to aerial temperature is more vital to the success of a plant at its early growth stage (Ketcheson, 1970; Knoll, Brady and Lathwell, 1963; Mederski and Jones, 1963). Corn yields were higher under heated soil conditions, and the period from emergence to silking was shortened (Ketcheson, 1970; Merdeski and Jones, 1963). Also, increased soil temperatures also shortened the period from emergence to silking by approximately 3 days, and uniformity of stands was improved (Ketcheson, 1970).

To some extent temperature influences nutrient uptake and yield relationships in corn (Gallaher, Parks and Josephson, 1972). Availability of nutrients in the soil is also critical when growing crops. With low potassium in the soil, potassium in the leaf tissue increased as temperatures increased (Mederski and Jones, 1963). Plant uptake of nitrogen, phosphorus and potassium was higher at higher temperatures of the soil, and no interaction between hybrids and soil temperature or hybrids and fertilizer were seen (MacLean and Donovan, 1973). Potassium is an essential element required in large quantities for high crop yields (Welch and Flannery, 1985). Furthermore, potassium plays an important role in some plant physiological processes such as photosynthesis and transpiration. Photosynthesis decreased with decreasing potassium concentration of the leaf tissues although chlorophyll content was not affected (Peaslee and Moss, 1965).

since these photosynthetic processes are important in plant growth and development, potassium has an influence on plant growth. On the same basis, potassium when applied as potash often improves emergence and growth of sweet corn plants especially on cold soils (Potash and Phosphate Institute, 1978). Alfalfa plants suffered winter injury while crop density and yields were reduced when low on no potassium fertilizer was used (Bailey, 1983). Responses of plants to potash are influenced by kinds of plants, soil characteristics, fertilizer applications, tillage and moisture (Haskell, 1949). Although importance of potassium has been documented, more attention has been paid to nitrogen and phosphorus fertilizers than to potassium fertilizer in relation to sweet corn growth. Potassium fertilizer may be overlooked because it is readily available in most soils compared to nitrogen and phosphorus (Hartman, et. al. 1988.). Studies involving potassium fertilizer usually combine potassium with nitrogen and phosphorus. However, potassium fertilizer improved growth of 'Jubilee' sweet corn plants by increasing numbers of tillers (Peck and MacDonald, 1973). Dry weight of maize plants also increased nearly four to six times with higher levels of potassium over controls without potassium (Estes, Koch and Breutsch, 1973). However, higher levels of potassium did not affect dry or fresh weight of ears (MacLean and Donovan, 1973; Peck and MacDonald, 1973). Potassium also affects uptake of other elements such as

calcium and magnesium as its concentration in plants tissue increased. Potassium decreased the concentration of calcium and to a greater extent that of magnesium in the vegetative portions of sweet corn plants (Peck and MacDonald 1973; Peck, MacDonald and Barnard, 1989). With higher potassium, concentrations of potassium increase illustrating luxury consumption of potassium by maize plants (Estes et. al., 1973). Differences in potassium uptake also may be related to stage of growth and soil fertility (Gallaher, Parks and Josephson 1972; Hanway, 1961;Taylor and Smith, 1958). Younger plants may require potassium in lesser amounts compared to older plants. Potassium concentrations in younger plants were low compared to older plants of maize (Estes et. al., 1973). In contrast, relative potassium uptake was rapid early in the season and slower as corn plant matured (Hanway, 1961).

Fertilizer can be applied either by banding or by broadcasting. In the U.S banding has been used extensively, especially for crops grown in widespaced rows such as maize, tobacco, cotton and potatoes (Prummel, 1957). Better yields were associated with banded compared to broadcasted fertilizer, and banding also has an advantage of saving fertilizer (Prummel, 1957). For fertilizers such as potash and phosphate, banding is recommended since they become quickly fixed when mixed with the soil (Prummel, 1957). Furthermore, fertilizer placed near seed advanced development of seedlings and increased yields in corn (Ketcheson, 1970; Prummel, 1957).

Also, banded phosphorus fertilizer overcame effects of sub optimum soil temperature in corn plants (Ketcheson, 1970). In addition, banded potassium fertilizer increased the amount of potassium in leaf tissues (Peck ,MacDonald and Barnard, 1989; Vasilas et.al., 1988). A localized concentration of any fertilizer reduced fixation of fertilizer by the soil and influenced uptake (Prummel, 1957). Banded fertilizer encourages vigorous root development known as morphological compensation (Prummel, 1957; Wilkonson and Ohlrogge, 1961). Thus, banded potash is important to young plants with a limited root system, particularly in cold and compacted soils (Potash and Phosphate Institute, 1978).

Response of sweet corn plants to potassium and temperature were studied. Various parameters were used as indicators of emergence and growth. Among others, leaf number and plant maturity were studied to determine effects of environmental factors on hybrid corn (Allen, McKee, McGahen, 1972). Dry weight, leaf area, % emergence, plant height, and potassium element content of plants have proved to be reliable in assessing environmental effects on plants (Mederski and Jones 1963; MacLean and Donovan 1973 and Haskel, 1949). While these parameters may be used as indicators of emergence and growth, soluble solids can be used to indicate field tolerance to environmental stress. Soluble solids showed differences between species of <u>Phaseolus</u> where tepary showed tolerance to salt compared to navy and backcross (Coons and Pratt, 1988).

In order to further understand controlling factors involved in the field, growth chamber studies are often done. For example, controlled environments such as growth chambers identify specific causal effects related to physiological problems encountered in the field. Swiader and Gerber (1984) found that growth of sweet corn seedlings was inhibited at low temperatures from studies done on the growth chamber. Also, vigorous responses of the shoot to phosphorus application at higher temperatures was found to decrease the amount of zinc in plant tissues. Although it is imperative to compare growth chamber experiments and field experiments, most studies done tend to separate the two.

CHAPTER 3

MATERIALS AND METHODS

Plants were grown in field plots or in growth chamber with similar parameters measured on plants from both locations. Sweet corn (Zea mays L.var. rugosa) seed was obtained from Illinois Foundation Seeds Inc (Champaign,Il). Supersweet corn cultivars used were 'Illini Gold','Florida Staysweet', 'Crisp'n'Sweet', 'Honey'n'Pearl' and 'How Sweet It Is'. All seeds were treated with Captan, Thiram, Imazalil, Apron and Sucrost K (CTIASK).

Field Studies

Field experiments were at the University of Illinois experimental farm in Urbana, Illinois between April 18 and July 22, 1991. The soil type was Drummer silty clay loam. Standard cultural practices including 9 kg/ha of Lasso and 4.5 kg/ha of Atrazin were used as herbicides. Seeds of each cultivar were planted in 3.7 x 6.4 m plots. An Ames hand planter was used to plant seeds in plots with 4 rows in each plot. For each plot, one of three levels of muriate of potash (62 % K_2O and 98.6 % KCl) fertilizer were used with 0, 45 and 90 kg/ha of potash. Vermiculite was provided by George Keller and Son's Company, Quincy, Il. Fertilizer was provided by Miller farm services, Mattoon, Il. After seeds were planted, grooves were made with hoes approximately 5 cm away from the row and at a depth of 5 cm fertilizer was applied evenly across the groove. The grooves were then closed. Plots were

arranged in a randomized complete block design with 4 replications. Each row had 25 seeds about 26 cm apart. Seeds were planted on April 18 for the cold planting and on June 4 for the warm planting.

Plant parameters were measured after 15, 32 and 48 or 49 days for both plantings. Fifteen days after planting (DAP), percent emergence plus plant height and number of leaves from every third plant were determined in the second row. Height was measured from soil surface to the tip of a youngest leaf on the stem and the number of leaves was determined by counting all the leaves on the stem including the newest leaflet. Three seedlings from the third row were sampled by cutting the seedling at soil surface for leaf area, chlorophyll concentration, soluble solids, potassium content, fresh weight and dry weight analyses. Leaf area of a whole seedling was determined using a digital Li-Cor area meter (Model 3100, Lincoln, NE) calibrated with 10 and 50 cm^2 disks. The same seedling used for leaf area was used to determine fresh weight and then dried at 80^0C for three days to determine dry weight. Dry seedlings were stored for potassium analysis. Soluble solids were determined from the youngest well expanded leaf of the seedling. To measure chlorophyll, tips of young and well expanded leaves were cut and immersed in 250 ml jars filled with 95% ethanol in the field. Jars were then capped, kept in the dark and were brought to the laboratory for analysis. At 32 days after planting, similar

procedures of sampling and measurements were made for the cold planting and the warm planting. Measurements of most parameters were not measured at 48 DAP for the warm planting because plants had already passed the seedling stage.

For both plantings, temperature at a depth of about 10-15 cm was recorded on the planting day and approximately every two weeks after using a digital thermocouple thermometer (Wescor Inc., Logan, UT) with a copper-constantan thermocouple (Appendix C). Rainfall, daily air temperature and relative humidity were recorded at a nearby weather station (Champaign, Il) (Appendix C). Soil samples were taken near the rows at 7.5 and 15.0 cm on the planting day and at 15.0 cm at the end of the experiment from all treatments using a soil probe. Six samples per plot were collected and mixed together. Soil samples were analyzed for pH, phosphorus and potassium and percent organic matter by Eastern Illinois Soil Testing. Their levels are shown in Appendix C.

Growth Chamber Studies

Plants were grown in growth chambers (Model CEL 257 and Model CEL 25-7, Sherer, Marshall, MI.) at two temperatures for two runs. For the first run, temperatures were 17.1 $\pm$ 1.9^{0}C with relative humidity of 98 $\pm$ 11% and 25.8 $\pm$ 2.5^{0}C with relative humidity of 74 $\pm$ 9%. For the second run, temperatures were 17.9 $\pm$ 1.8^{0}C with relative humidity 85 $\pm$ 12% and 26.2 $\pm$ 1.8^{0}C with relative humidity of 76 $\pm$ 9%. A digital thermocouple thermometer (Wescor, Inc., Logan, UT) was placed

at tray level daily to measure temperature and relative humidity. Plants grew with a combination of cool white fluorescent and incandescent bulbs for 12 hours per day. Light levels were 273 $\pm$ 81 umol m^{-2} s^{-1} at the lower temperature and 186 $\pm$ 54 umol m^{-2} s^{-1} at the higher temperature as measured with a Li-Cor light meter (Model Li-185A) with a quantum sensor (Li-Cor Inc, Lincoln, NE) at tray level.

Seeds of each cultivar were planted in 6 x 22 x 30 cm plastic trays (Carolina Biological Supplies, Burlington, NC) in vermiculite (Peter's professional, Horticulture grade). One of three amounts 0. 5 Or 10 g of potash was mixed with vermiculite at rates of fertilizer per tray. Trays were arranged in a completely randomized design with three replications. Ten seeds of each cultivar were planted into one of five evenly spaced rows in each tray. Deionized water was used to water plants at the start and every second day. To ensure an adequate supply of water, water was supplied until excess water was seen dripping through the holes at the bottom of the trays.

Plants were harvested after 15 days. Percent emergence was determined. Leaf number, plant height, soluble solids, dry weight and fresh weight were determined from every third plant on each row of the tray. These parameters were measured in same way as in field.

Plant Analyses

Chlorophyll

Fresh plant material was placed into 250 ml jars, covered with 95% ethanol, capped and stored in the dark for 24 hours at room temperature (Knudson, Tibbitts and Edwards, 1977). Ethanol was decanted from jars with tissue into other 250 ml jars, and then tissue was covered with ethanol and stored in the dark for 24 hours. This process was repeated until tissues turned white. Tissues were dried for 2 days at $80^{0}C$ and weighed. Ethanol solutions were brought to equal volumes of 250 ml or 200 ml except for the growth chamber experiments where they were brought to either 100 or 125 ml. A spectronic 20 (Rochester, NY.) was used to determine absorbance of the chlorophyll-ethanol solutions at 649nm and 665nm. Chlorophyll content of the tissue was calculated as follows:

$$\frac{\text{ug chl a}}{\text{ml solution}} = (13.70)(A_{665nm})-(5.76)(A_{649nm})$$

$$\frac{\text{ug chl b}}{\text{ml solution}} = (25.80)(A_{649nm})-(7.60)(A_{665nm})$$

$$\frac{\text{ug chl a}}{\text{mg tissue}} = \frac{\text{ug chl a}}{\text{ml solution}} \quad \frac{(\text{x ml solution})}{(\text{x mg tissue})}$$

Potassium analysis

Plant tissue was oven dried at $80^{0}C$ for three days. Tissue was ground using a Wiley mill (Philadelphia, PA) through a 60 mesh and then 0.1 g of ground tissue was weighed. Weighed ground tissue was placed into 50 ml volumetric flasks. Six milliliters of 100% concentrated nitric acid were added to each volumetric flask. Volumetric flasks were then put on a Lindberg industrial hot plate on intermediate heat. The solutions were boiled lightly for 15 minutes until all brown fumes cleared the flasks. Hydrogen peroxide was added dropwise

until the solution was clear. The solutions were heated further until the brown color reappeared. Hydrogen peroxide was added again in the same manner as above. After the brown color had reappeared, flasks were removed from the hotplate, cooled and then diluted to 50 ml with distilled water. Two milliliter aliquots for each sample were brought to volume with distilled water in 50 ml digesting tubes. Potassium was determined by flame emission, using an atomic absorption spectrophotometer (Perkin Elmer, model 360) at wavelength 766.5 nm. The slit setting was at 2.0 mm, and the air-acetyl flame was used. A standard curve was developed using 0, 1, 5, 10 and 20 ppm KNO^{-3} (Appendix D).

Soluble solids

A well expanded leaf on the plant was cut and crushed using a mortar and pestle for the field experiments. For the growth chamber experiments, a whole seedling was used. Fresh plant tissue was ground in a mortar and pestle until a considerable amount of liquid was available. A few drops of tissue liquid were transferred to a measuring prism on the Reichert-Jung T/C* hand refractometer (Model 10431, Leica Inc, Buffalo, NY.) using a plastic dipstick. The cover plate was then closed over the prism to take readings of percent soluble solids.

Statistical Analysis

All parameters were analyzed using a two-way analysis of variance with a randomized complete block design for the field

experiments and a completely randomized design for the growth chamber experiments. Two factors in each ANOVA were cultivar and fertilizer. Whenever a significant interaction was found between the two factors, a one-way analysis of variance was done on individual factors. Differences between parameter means for different cultivars at different fertilizer levels were compared using Duncan's multiple range test at P=0.05. The CoStat program was used for all statistical analyses.

CHAPTER 4

RESULTS

Field studies

Two-way analysis of variance for the number of emerged plants revealed significant differences between cultivars, however no potash effect for all sampling days of the cold planting (Appendix B). A significant block effect was revealed 32 days after planting. No interaction between cultivar and potash was revealed. After 15 days, 'Crisp'n'Sweet', 'Illini Gold' and 'Florida Staysweet' had more plants emerged than 'How Sweet It Is' or 'Honey'n'Pearl' (Table 1). After 32 days, 'Florida Staysweet','Crisp'n'Sweet' and 'Illini Gold' had more plants emerged than 'How Sweet It Is' which had more emerged than 'Honey'n'Pearl'. After 49 days, cultivar responses were the same as at 32 days. No significant potash effect was revealed on any sampling day.

Responses for the warm planting were similar, except for the 32 and 48 days after planting where a significant interaction between cultivar and potash was revealed (Appendix B; Table 2). Due to significant interaction, data on individual levels of potash and cultivars were separated and one-way analyses of variance were run independently. One-way analysis of variance for the number of plants emerged after 32 days for warm planting revealed no significant differences between potash levels. Only significant cultivar differences were revealed for the number of plants emerged at

Table 1. Number of sweet corn plants emerged from 25 seeds at 15, 32 and 49 days after planting in cold field soils with three potash levels and five cultivars.

	Days after planting		
Potash (kg/ha)	15	32	49
0	5.0±5.1a[z,y]	13.0±6.5a	13.0±6.7a
45	6.0±5.1a	14.0±6.4a	13.0±6.5a
90	6.0±5.3a	14.0±7.7a	14.0±7.8a
Cultivar			
Illini Gold	9.0±5.3a[x]	18.0±4.9a	18.0±4.8a
Florida Staysweet	8.0±2.8a	19.0±2.2a	19.0±2.2a
Crisp'n'Sweet	9.0±4.0a	18.0±2.6a	18.0±3.0a
Honey'n'Pearl	1.0±1.0b	3.6±2.0c	3.5±2.4c
How Sweet It Is	1.0±1.2b	10.0±2.2b	9.4±2.5b

[z] mean separation of lumped means within a column for all potash levels based on Duncan's multiple range at P=0.05.

[y] means are lumped because no significant interaction between cultivars and potash.

[x] mean separation of lumped means within a column for all cultivars based on Duncan's multiple range at P=0.05.

Table 2. Number of sweet corn plants emerged from 25 seeds at 15, 32, and 48 days after planting in warm field soils for three potash levels and five cultivars.

	Days after planting		
Potash (kg/ha)	15	32	48
0	4.0±3.2a[z,y]	12.0±7.2a	12.0±7.5a
45	5.0±4.1a	12.0±6.8a	12.0±6.7a
90	5.0±3.1a	12.0±5.7a	11.0±5.8a
Cultivar			
Illini Gold	6.0±3.5a[x]	18.0±2.7a	17.0±3.0a
Florida Staysweet	7.0±4.1a	17.0±2.6a	17.0±3.0a
Crisp'n'Sweet	4.0±2.4ab	14.0±3.6b	14.0±3.9b
Honey'n'Pearl	2.0±1.1b	3.0±1.5d	3.0±1.3d
How Sweet It Is	4.0±3.3ab	7.0±2.8c	7.0±2.7c

[z] mean separation of lumped means within a column for all potash levels based on Duncan's multiple range at P=0.05.

[y] means are lumped because no significant interaction between cultivars and potash levels.

[x] mean separation of lumped means within a column for all cultivars based on Duncan's multiple range at P=0.05.

each individual potash level. When no potash was applied,'Illini Gold' and 'Florida Staysweet' had more plants emerged, followed by 'Crisp'n'Sweet' and then 'How Sweet It Is' and' Honey'n'Pearl' at 32 days after planting (Table 3). At 45 kg/ha of potash, 'Illini Gold' and 'Florida Staysweet' had most plants emerged, 'Crisp'n'Sweet' and 'How Sweet It Is' were intermediate and then 'Honey'n'Pearl' had the least emerged. At 90 kg/ha of potash, a significant block effect was revealed. At the same time 'Crisp'n'Sweet', 'Illini Gold' and 'Florida Staysweet' had most plants emerged, with 'How Sweet It Is' intermediate, and then 'Honey'n'Pearl' the least. A one-way analysis of variance for plant emergence after 48 days for the warm planting revealed no significant differences between potash levels for each individual cultivar . Significant cultivars differences were revealed for each potash level. When no potash was applied, 'Illini Gold' and 'Florida Staysweet' had more plants emerged, followed by 'Crisp'n'Sweet' and then 'Honey'n'Pearl' and 'How Sweet It Is' were poor emergers (Table 4). When 45 kg/ha of potash was applied, 'Illini Gold' and 'Florida Staysweet' had more plants emerged, followed by 'Crisp'n'Sweet' and 'How Sweet It Is' and then 'Honey'n'Pearl' was the poor emerger (Table 4). When 90 kg/ha of potash were applied, 'Crisp'n'Sweet', 'Florida Staysweet' and 'Illini Gold' had most emerged plants, 'How Sweet It Is' was intermediate and then 'Honey'n'Pearl' was the poor emerger (Table 4).

Table 3. Number of plants emerged from 25 seeds at 32 days after planting in warm field soils with three potash levels and five cultivars.

	Potash (kg/ha)		
Cultivar	0	45	90
Illini Gold	19.0±2.1a[z]	19.0±3.0a	16.0±2.1a
Florida Staysweet	18.0±1.5a	18.0±2.4a	15.0±3.1a
Crisp'n'Sweet	13.0±4.8b	12.0±4.0b	17.0±1.3a
Honey'n'Pearl	3.0±1.7c	3.0±1.3c	3.0±1.7c
How Sweet It Is	5.0±2.6c	9.0±3.4b	8.0±0.9b

[z] abc to separate means within the column based on Duncan's multiple range at P=0.05; mean separation within a row showed no significant differences based on Duncan's multiple range at P=0.05.

Table 4. Number of plants emerged from 25 seeds at 48 days after planting in warm field soils with three potash levels and five cultivars.

	Potash (kg/ha)		
Cultivar	0	45	90
Illini Gold	19.0±2.2a[z,y]	18.0±3.3a	15.0±2.6a
Florida Staysweet	19.0±3.0a	18.0±1.5a	15.0±3.2a
Crisp'n'Sweet	14.0±4.7b	12.0±3.8b	17.0±1.3a
Honey'n'Pearl	3.0±1.7c	2.0±1.0c	3.0±1.4c
How Sweet It Is	5.0±2.6c	9.0±3.6b	7.0±0.8b

[z] abc to separate means within a column based on Duncan's multiple range at P=0.05; mean separation within a row showed no significant differences based on Duncan's multiple range at P=0.05.

Two-way analysis of variance for height of seedlings grown in cold soils revealed significant cultivar differences and no potash effect at 15 and 32 days after planting in cold soils (Appendix B). 'Illini Gold', 'Florida Staysweet' and 'Crisp'n'Sweet' had taller plants than 'Honey'n'Pearl' and 'How Sweet It Is' after 15 and 32 days (Table 5). After 49 days, no cultivar or potash differences were revealed.

For the warm planting, significant cultivar differences in height of seedlings were revealed 15 and 48 days after planting. At 15 DAP, 'Crisp'n'Sweet' had the tallest plants followed by 'Florida Staysweet' and then 'Illini Gold', and then 'How Sweet It Is' and 'Honey'n'Pearl' (Table 6). At 48 DAP, 'Illini Gold', 'Florida Staysweet', 'Crisp'n'Sweet' and 'How Sweet It Is' had the tallest plants than 'Honey'n'Pearl' (Table 6). No significant potash effect was revealed at 32 days after planting. No interaction between cultivar and potash was revealed after 15 or 32 days after planting. An interaction of cultivar and potash was revealed 48 days after planting in warm field soils (Appendix B). One-way analysis of variance revealed significant potash differences only for 'Florida Staysweet'. Height was greatest with 45 kg/ha of potash, intermediate with 90 kg/ha of potash and lowest when no potash was applied. Also, cultivar differences were revealed when no potash or 45 kg/ha potash were applied (Table 7). When no potash was applied, 'Illini Gold' and 'Crisp'n'Sweet' had the tallest plants, 'Florida Staysweet'

Table 5. Height(cm) of sweet corn plants at 15, 32, and 49 days after planting in cold field soils with three potash levels and five cultivars.

	Days after planting		
Potash (kg/ha)	15	32	49
0	1.5±1.0a[z,y]	8.8±1.8a	28.1±5.8a
45	1.6±1.0a	9.1±2.0a	31.3±4.4a
90	1.6±1.3a	8.5±2.5a	29.6±7.9a
Cultivar			
Illini Gold	2.2±0.7a[x]	9.8±1.3a	29.1±2.7a
Florida Staysweet	2.1±0.6a	9.2±1.9a	31.9±4.4a
Crisp'n'Sweet	2.1±0.7a	10.0±2.0a	32.4±4.9a
Honey'n'Pearl	0.9±1.2b	7.1±2.6b	27.3±10.5a
How Sweet It Is	0.5±0.9b	7.8±1.6b	27.5±4.3a

[z] mean separation within a column of lumped means for all potash levels based on Duncan's multiple range at P=0.05.

[y] means are lumped because no significant interaction between cultivar and potash.

[x] mean separation of within a column of lumped means for all cultivars based on Duncan's multiple range at P=0.05.

Table 6. Height(cm) of sweet corn plants at 15, 32, and 48 days after planting in warm field soils with three potash levels and five cultivars.

	Days after planting		
Potash (kg/ha)	15	32	48
0	7.0±2.6b[z,y]	24.7±7.7a	75.1±33.8a
45	7.1±2.9ab	24.5±6.2a	76.4±29.8a
90	8.5±2.1a	24.1±5.8a	76.3±27.0a
Cultivar			
Illini Gold	7.2±2.7bc[x]	23.4±6.8a	91.5±34.6a
Florida Staysweet	8.8±1.9ab	27.7±3.9a	89.7±27.7a
Crisp'n'Sweet	9.3±2.4a	26.7±7.1a	81.1±24.8a
Honey'n'Pearl	6.5±2.0c	23.0±6.1a	46.2±12.5b
How Sweet It Is	6.0±2.6c	21.3±6.8a	70.9±23.7a

[z] mean separation of lumped means within a column for all potash levels based on Duncan's multiple range at P=0.05

[y] means are lumped because no significant interaction between cultivar and potash.

[x] mean separation of lumped means within a column for all cultivars based on Duncan's multiple range at P=0.05

Table 7. Height(cm) of sweet corn seedlings at 48 days after planting in warm field soils with three potash levels and five cultivars.

	Potash (kg/ha)		
Cultivar	0	45	90
Illini Gold	107.0±42.1a[z]	75.3±28.0b	92.2±34.1a
Florida Staysweet	69.7± 7.8ab	117.5± 9.9a	82.2±32.0a
Crisp'n'Sweet	98.0±34.2a	68.6±17.1bc	76.8±13.5a
Honey'n'Pearl	47.6±14.4b	42.2±11.5c	49.0±14.2a
How Sweet It Is	53.2±16.4b	78.2±20.4b	81.3±25.5a

[z] ab to separate means within a column based on Duncan's multiple range at P=0.05; mean separation within a row showed no significant differences based on Duncan's multiple range at P=0.05.

was intermediate, and 'How Sweet It Is' and 'Honey'n'Pearl' had the shortest plants. When 45 kg/ha potash was applied, 'Florida Staysweet' had the tallest plants, followed by 'How Sweet It Is', 'Illini Gold' and 'Crisp'n'Sweet' and then 'Honey'n'Pearl' had the shortest plants (Table 7).

Two-way analysis of variance for fresh weight of seedlings revealed significant cultivar differences and no potash differences for all sampling days of the cold planting (Appendix. B). No significant interaction between cultivar and potash was revealed at any sampling days of the cold planting. At 15 days after planting, 'Florida Staysweet', 'Illini Gold' and 'Crisp'n'Sweet' weighed more than 'Honey'n'Pearl' or 'How Sweet It Is' (Table 8). At 32 days after planting, 'Crisp'n'Sweet' and 'Florida Staysweet' had the greatest fresh weight followed by 'Illini Gold' and then 'How Sweet It Is' and then 'Honey'n'Pearl' (Table 8). At 49 days after planting all cultivars had similar fresh weights except 'How Sweet It Is' which was lower.

For the warm planting, no significant cultivar differences for fresh weight were revealed at 32 days after planting. Significant cultivar differences were seen 15 days after planting (Appendix B). No significant potash effect was revealed at any sampling day. No significant interaction between cultivar and potash was revealed. At 15 days after planting, 'Florida Staysweet' weighed more followed by 'Crisp'n'Sweet' and 'Illini Gold' followed by 'How Sweet It

Table 8. Fresh weight(g) of sweet corn shoots at 15, 32, and 49 days after planting in cold field soils with three potash levels and five cultivars.

	Days after planting		
Potash (kg/ha)	15	32	49
0	0.08±0.0a[z,y]	1.17±0.49a	24.54±14.18a
45	0.08±0.94a	1.07±0.65a	31.07±13.28a
90	0.06±0.05a	1.20±0.69a	28.28±18.86a
Cultivar			
Illini Gold	0.10±0.02a[x]	1.24±0.52ab	28.26± 9.75a
Florida Staysweet	0.11±0.03a	1.42±0.34a	38.33±11.00a
Crisp'n'Sweet	0.09±0.02a	1.52±0.87a	31.57±14.07a
Honey'n'Pearl	0.04±0.03b	0.72±0.35c	27.93±22.00a
How Sweet It Is	0.03±0.00b	0.82±0.38bc	13.70± 7.46b

[z] mean separation of lumped means within a column for all potash levels based on Duncan's multiple range at P=0.05.

[y] means are lumped because of no significant interaction between cultivar and potash.

[x] mean separation of lumped means within a column for all cultivars based on Duncan's multiple range at P=0.05.

Is' and then 'Honey'n'Pearl' (Table 9). At 49 days after planting, no data was taken.

Two-way analysis of variance for dry weight of seedlings revealed significant cultivar differences and no significant potash effects at 32 and 49 days after planting in cold field plots (Appendix B). After 15 days no cultivar or potash differences were revealed. No significant interactions between cultivar and potash were revealed at any sampling day. At 32 days after planting 'Crisp'n'Sweet, 'Illini Gold' and 'Florida Staysweet' had higher dry weights than 'How Sweet It Is' or 'Honey and Pearl' (Table 10). At 49 days, all cultivars had higher weights than 'How Sweet It Is' (Table 10).

For the warm planting, no significant cultivar or potash differences in dry weight were revealed at any sampling day (Table 11). No interaction between cultivar and potash was revealed (Appendix B).

Two-way analysis of variance for leaf area of seedlings revealed significant cultivar differences and no potash effects at any sampling day for the cold planting (32 and 49 DAP). No interactions between cultivar and potash were revealed at any sampling day. After 32 days, 'Illini Gold', 'Crisp'n'Sweet' and 'Florida Staysweet' had greater leaf areas than 'How Sweet It Is' or 'Honey'n'Pearl' (Table 12). After 49 days, all cultivars had greater leaf areas than 'How Sweet It Is' (Table 12).

For the warm planting, significant cultivar differences

Table 9. Fresh weight(g) of sweet corn shoots at 15, 32, and 48 days after planting in warm field soils with three potash levels and five cultivars.

	Days after planting	
Potash (kg/ha)	15	32
0	1.06 ± 0.75a[z,y]	6.06 ± 5.20a
45	1.00 ± 0.64a	8.35 ± 12.72a
90	0.94 ± 0.65a	7.19 ± 4.14a
Cultivar		
Illini Gold	1.10 ± 0.47ab[x]	5.93 ± 3.06a
Florida Staysweet	1.47 ± 0.72a	11.61 ± 15.78a
Crisp'n'Sweet	1.13 ± 0.78ab	9.21 ± 4.86a
Honey'n'Pearl	0.41 ± 0.27c	2.95 ± 3.07a
How Sweet It Is	0.91 ± 0.61bc	6.30 ± 5.00a

[z] mean separation of lumped means within a column for all potash levels based on Duncan's multiple range at P=0.05

[y] means are lumped because no significant interaction between cultivar and potash.

[x] mean separation of lumped means within a column for all cultivars based on Duncan's multiple range at P=0.05.

Table 10. Dry weight(g) at 15, 32, and 49 days after planting in cold field soils with three potash levels and five cultivars.

	Days after planting		
Potash (kg/ha)	15	32	49
0	0.08±0.00a[z,y]	0.162±0.08a	3.933±2.42a
45	0.014±0.03a	0.143±0.08a	4.831±2.09a
90	0.006±0.00a	0.135±0.07a	4.451±2.68a
Cultivar			
Illini Gold	0.010±0.00ab[x]	0.178±0.06a	4.306±1.43a
Florida Staysweet	0.022±0.04a	0.164±0.05a	5.870±1.61a
Crisp'n'Sweet	0.010±0.00ab	0.204±0.09a	5.244±1.80a
Honey'n'Pearl	0.003±0.00b	0.084±0.04b	4.408±3.62a
How Sweet It Is	0.003±0.00b	0.102±0.04b	2.194±1.18b

[z] mean separation of lumped means within a column for all fertilizers based on Duncan's multiple range at P=0.05.

[y] means are lumped because no significant interaction between cultivar and potash.

[x] mean separation of lumped means within a column for all cultivars based on Duncan's multiple range at P=0.05.

Table 11. Dry weight(g) of sweet corn shoots at 15 and 32 days after planting in warm field soils with three potash levels and five cultivars.

	Days after planting	
Potash (kg/ha)	15	32
0	0.12 ± 0.09a[z,y]	0.09 ± 0.91a
45	0.13 ± 0.08a	1.34 ± 2.26a
90	0.18 ± 0.18a	1.08 ± 0.68a
Cultivar		
Illini Gold	0.17 ± 0.06a[x]	0.87 ± 0.41a
Florida Staysweet	0.17 ± 0.10a	1.84 ± 2.84a
Crisp'n'Sweet	0.21 ± 0.22a	1.44 ± 0.87a
Honey'n'Pearl	0.06 ± 0.05a	0.49 ± 0.51a
How Sweet It Is	0.12 ± 0.08a	1.03 ± 0.88a

[z] mean separation of lumped means within a column for all potash levels based on Duncan's multiple range at P=0.05.

[y] means are lumped because no significant interaction between cultivar and potash.

[x] mean separation of lumped means within a column for all cultivars based on Duncan's multiple range at P=0.05.

Table 12. Leaf area(cm^2) at 32 and 49 days after planting in cold field soils with three potash levels and five cultivars.

	Days after planting	
Potash (kg/ha)	32	49
0	33.9 ± 13.9a[z,y]	493.3 ± 291.5a
45	33.2 ± 21.4a	577.0 ± 283.6a
90	34.5 ± 17.1a	525.5 ± 311.2a
Cultivar		
Illini Gold	41.9 ± 15.8a[x]	638.4 ± 211.7a
Florida Staysweet	40.4 ± 14.8a	717.5 ± 176.3a
Crisp'n'Sweet	41.2 ± 20.8a	561.9 ± 177.4a
Honey'n'Pearl	21.2 ± 12.3b	513.2 ± 428.7a
How Sweet It Is	24.6 ± 12.0b	228.6 ± 128.8b

[z] mean separation of lumped means within a column for all potash levels based on Duncan's multiple range at P=0.05.

[y] means are lumped because no significant interaction between cultivars and potash.

[x] mean separation of lumped means within a column for all cultivars based on Duncan's multiple range at P=0.05.

in leaf area at 15 days after planting were revealed (Appendix B). No potash effect was revealed at any sampling day. No significant interactions between cultivar and potash were revealed at any sampling day. At 15 days, 'Illini Gold' and 'Crisp'n'Sweet' had the greatest leaf areas, 'Florida Staysweet' and 'How Sweet It Is' were intermediate, and 'Honey'n'Pearl' had the least leaf areas (Table 13).

Two-way analysis of variance for the number of leaves on seedlings revealed significant cultivar differences at 32 and 49 days after the cold planting (Appendix B). After 32 days, 'Crisp'n'Sweet', 'Florida Staysweet', 'Illini Gold' and 'Honey'n'Pearl' had more leaves than 'How Sweet It Is' After 49 days, all cultivars had more leaves than 'Honey'n'Pearl' (Table 14).

For the warm planting, significant cultivar differences and no potash effect were revealed for the number of leaves at 15 and 32 days after planting (Appendix B). An interaction between cultivar and potash was revealed 15 days planting (Appendix B). Due to the interaction, data for individual potash levels and individual cultivars were analyzed separately by a one-way analysis of variance. At 15 days after planting, 'Illini Gold' had the most leaves followed by 'Crisp'n'Sweet' and 'Florida Staysweet' and then 'How Sweet It Is' and lastly 'Honey'n'Pearl' (Table 15). After 32 days, all cultivars had more leaves than 'Honey'n'Pearl' (Table 15). For number of leaves at 15 days after planting a significant

Table 13. Leaf area (cm^2) at 15 and 32 days after planting in warm field soils with three potash levels and five cultivars.

	Days after planting	
Potash (kg/ha)	15	32
0	22.7 ± 17.1a[z,y]	79.4 ± 53.5a
45	23.3 ± 15.3a	127.3 ± 209.7a
90	23.0 ± 12.8a	101.1 ± 55.8a
Cultivar		
Illini Gold	31.5 ± 12.1a[x]	91.8 ± 39.6a
Florida Staysweet	23.4 ± 15.8ab	171.3 ± 264.8a
Crisp'n'Sweet	26.9 ± 16.3a	118.8 ± 44.8a
Honey'n'Pearl	12.0 ± 8.8b	45.5 ± 42.6a
How Sweet It Is	21.1 ± 15.0ab	86.5 ± 58.9a

[z] mean separation of lumped means within a column for all potash levels based on Duncan's multiple range at P=0.05.

[y] means are lumped because no significant interaction between cultivars and potash.

[x] mean separation of lumped means within a column for all cultivars based on Duncan's multiple range at P=0.05.

Table 14. Number of leaves on sweet corn seedlings at 32 and 49 days after planting in cold field soils with three potash levels and five cultivars.

	Days after planting	
Potash (kg/ha)	32	49
0	4.6±1.2a[z,y]	9.4 ± 1.9a
45	4.3±1.0a	9.7 ± 1.9a
90	4.2±1.0a	9.5 ± 2.3a
Cultivar		
Illini Gold	4.4±0.8a[x]	10.1 ± 1.0a
Florida Staysweet	4.7±1.0a	10.6 ± 0.8a
Crisp'n'Sweet	4.8±1.2a	10.5 ± 1.0a
Honey'n'Pearl	4.3±1.0a	7.0 ± 3.0b
How Sweet It Is	3.5±0.8b	9.4 ± 0.9a

[z] mean separation of lumped means within a column for all potash levels based on Duncan's multiple range P=0.05.

[y] means are lumped because no significant interaction between cultivars and potash levels.

[x] mean separation for lumped means within a column for all cultivars based on Duncan's multiple range P=0.05.

Table 15. Number of leaves on sweet corn seedlings at 15 and 32 days after planting in field warm soils with three potash levels and five cultivars.

	Days after planting	
Potash (kg/ha)	15	32
0	3.1 ± 1.3a[z,y]	7.0 ± 1.9a
45	3.0 ± 1.2a	7.3 ± 1.6a
90	3.5 ± 1.2a	7.5 ± 1.5a
Cultivar		
Illini Gold	3.9 ± 1.1a[x]	7.9 ± 1.0a
Florida Staysweet	3.6 ± 0.9ab	7.9 ± 0.6a
Crisp'n'Sweet	3.6 ± 1.1ab	7.9 ± 1.0a
Honey'n'Pearl	2.1 ± 0.9c	5.3 ± 2.2b
How Sweet It Is	2.8 ± 1.2b	7.1 ± 1.3a

[z] mean separation of lumped means within a column for all potash levels based on Duncan's multiple range at P=0.05.

[y] means are lumped because no significant interaction between cultivar and potash.

[x] mean separation of lumped means within a column for all cultivars based on Duncan's multiple range at P=0.05.

potash effect was revealed for 'How Sweet It Is' (Table 16). The number of leaves for 'How Sweet It Is' were greater at 45 and 90 kg/ha of potash than with no fertilizer (Table 16). One-way analysis of variance further revealed significant cultivar differences when no potash or 45 kg/ha of potash was applied. When no potash was applied, 'Crisp'n'Sweet' and 'Illini Gold' had more leaves, than 'Florida Staysweet', 'Honey'n'Pearl' and 'How Sweet It Is' had fewer leaves. When 45 kg/ha of potash was applied, 'Florida Staysweet' had the highest number of leaves followed by 'How Sweet It Is', 'Crisp'n'Sweet' and 'Illini Gold' were intermediate and 'Honey'n'Pearl' had fewer leaves.

Two-way analysis of variance for chlorophyll a in plant tissue revealed a significant block effect, and no significant differences between cultivars or fertilizers at 15 days after the cold planting (Appendix B). Significant cultivar differences but no potash effects were revealed at 32 and 49 days after the cold planting. No significant interactions between cultivar and potash were revealed at any of the cold planting sampling days. After 32 days, 'Florida Staysweet' had the most chlorophyll a, 'Crisp'n'Sweet' was intermediate and then 'Honey'n'Pearl', 'How Sweet It Is' and 'Illini Gold' had the least (Table 17) . After 49 days, 'How Sweet It Is' had the most chlorophyll a followed by 'Crisp'n'Sweet', ' Illini Gold' and 'Florida Staysweet' and then 'Honey'n'Pearl' (Table 17).

Table 16. Number of leaves on sweet corn seedlings at 15 days after planting in warm field soils with three potash levels and five cultivars.

	Potash (kg/ha)		
Cultivar	0	45	90
Illini Gold	4.0±0.4aw[z]	3.0±1.0bw	5.0±0.6aw
Florida Staysweet	3.0±1.1bw	4.0±0.3aw	4.0±0.6aw
Crisp'n'Sweet	4.0±0.4aw	3.0±1.1bw	4.0±1.3aw
Honey'n'Pearl	3.0±0.4bw	1.0±0.3cw	3.0±1.3aw
How Sweet It Is	2.0±1.3bx	4.0±0.4abw	3.0±1.0aw

[z] abc to separate means within the column based on Duncan's multiple range at P=0.05; wxy to separate means within a row based on Duncan's multiple range at P=0.05.

Table 17. Chlorophyll a (ug/mg dry weight) in sweet corn at 15, 32, and 49 days after planting in cold field soils with three potash levels and five cultivars.

	Days after planting		
Potash (kg/ha)	15	32	49
0	7.9±3.3a[z,y]	6.1±1.6a	7.7±0.8a
45	7.2±2.5a	6.9±1.5a	8.2±1.2a
90	7.6±1.6a	6.8±1.6a	7.9±0.8a
Cultivar			
Illini Gold	6.2±3.0b[x]	6.2±1.4b	7.9±1.6abc
Florida Staysweet	8.2±1.8a	7.9±1.6a	7.6±0.6bc
Crisp'n'Sweet	8.3±2.2a	6.7±1.6ab	8.4±0.8ab
Honey'n'Pearl	-	6.2±1.2b	7.3±0.5c
How Sweet It Is	-	6.2±1.4b	8.4±0.6a

[z] mean separation of lumped means within a column for all potash levels based on Duncan's multiple range at P=0.05.

[y] means are lumped because no significant interaction between cultivar and potash levels.

[x] mean separation of lumped means within a column for all cultivars based on Duncan's multiple range at P=0.05.

For the warm planting, no significant cultivar or potash differences were revealed for chlorophyll a at 15 and 32 days after planting (Appendix B; Table 18). A significant block effect was revealed 32 DAP.

Two-way analysis of variance for chlorophyll b on plant tissue revealed significant cultivar differences and no potash effects at 15 and 49 days after planting in cold field soils (Appendix B). A significant block effect and no cultivar effect was revealed 32 days after planting. No significant interaction between cultivar and potash were revealed at any sampling day. At 15 days after planting cold field soils, 'Crisp'n'Sweet' had the most chlorophyll b, 'Florida Staysweet' was intermediate and 'Illini Gold' had the least chlorophyll b. 'Honey'n'Pearl' and 'How Sweet It Is' did not have enough tissue for chlorophyll analysis (Table 19). At 49 DAP, 'Florida Staysweet', 'Crisp'n'Sweet', 'Honey'n'Pearl' and 'How Sweet It Is' had the most chlorophyll b than 'Illini Gold'(Table 19).

For warm planting, only significant potash differences and no cultivar differences for chlorophyll b were revealed 15 days after planting (Appendix B). After 15 days, chlorophyll b was highest with no potash, intermediate at 45kg/ha of potash and lowest at 90 kg/ha potash (Table 20). At 32 days after the warm planting, significant cultivar differences and no potash effect were revealed. 'Florida Staysweet' had the most chlorophyll b, 'How Sweet It Is',

Table 18. Chlorophyll a (ug/mg dry weight) in sweet corn at 15 and 32 days after planting in warm field soils with three potash levels and five cultivars.

	Days after planting	
Potash (kg/ha)	15	32
0	7.3 ± 1.0a[z,y]	8.8 ± 1.4a
45	6.6 ± 1.6a	9.0 ± 1.7a
90	8.9 ± 8.5a	9.3 ± 1.8a
Cultivar		
Illini Gold	6.8 ± 0.6a[x]	8.9 ± 2.0a
Florida Staysweet	7.7 ± 0.8a	9.3 ± 1.3a
Crisp'n'Sweet	7.8 ± 0.8a	9.5 ± 1.7a
Honey'n'Pearl	6.3 ± 0.7a	8.5 ± 1.9a
How Sweet It Is	9.4 ± 11.4a	9.0 ± 0.9a

[z] mean separation of lumped means within a column for all potash levels based on Duncan's multiple range at P=0.05.

[y] means lumped because no significant interaction between cultivar and potash levels.

[x] mean separation of lumped means within a column for all cultivars based on Duncan's multiple range at P=0.05.

Table 19. Chlorophyll b(ug/mg dry weight) in sweet corn plants at 15, 32, and 49 days after planting in cold field soils with three potash levels and five cultivars.

	Days after planting		
Potash (kg/ha)	15	32	49
0	6.9±3.2a[z,y]	5.5±1.7a	6.4±1.8a
45	7.3±2.5a	6.3±1.9a	6.4±2.0a
90	7.0±2.0a	6.1±1.6a	6.9±1.4a
Cultivar			
Illini Gold	5.8±3.0b[x]	5.1±1.4a	5.1±2.4b
Florida Staysweet	7.0±2.0ab	6.8±1.4a	6.6±0.9a
Crisp'n'Sweet	8.4±1.8a	5.7±1.9a	6.7±2.0a
Honey'n'Pearl	-	5.7±1.6a	6.6±0.4a
How Sweet It Is	-	6.5±1.9a	7.8±1.1a

[z] mean separation of lumped means within a column for all potash levels based on Duncan's multiple range at P=0.05.

[y] means are lumped because no significant interaction between cultivar and potash.

[x] mean separation of lumped means within a column for all cultivars based on Duncan's multiple range at P=0.05.

'Crisp'n'Sweet' and 'Illini Gold' were intermediate, and 'Honey'n'Pearl' had the least chlorophyll b (Table 20).

Two-way analysis of variance for total chlorophyll in plant tissue revealed significant cultivar differences at all sampling days except 32 days for the cold planting (Appendix B). No significant potash effect was revealed at any sampling day. No significant interaction between cultivar and potash was revealed. After 15 days, 'Crisp'n'Sweet' had the most total chlorophyll, 'Florida Staysweet' was intermediate, and 'Illini Gold' had the least total chlorophyll. 'Honey'n'Pearl' and 'How Sweet It Is' did not have enough tissue to analyze for chlorophyll. After 49 days, 'How Sweet It Is' had more total chlorophyll, 'Crisp'n'Sweet', 'Florida Staysweet' and 'Honey'n'Pearl' had intermediate total chlorophyll and 'Illini Gold' had the least total chlorophyll (Table 21).

For the warm planting, no significant cultivar or potash differences were revealed for total chlorophyll (Appendix B; Table 22). A significant block effect was revealed 32 DAP. At 15 days after the warm planting, a significant interaction between cultivar and potash was revealed (Appendix B). Data for individual cultivars and individual potash levels were analyzed separately by a one-way analysis of variance. 'Illini Gold', 'Crisp'n'Sweet', 'Florida Staysweet' and 'How Sweet It Is' showed no potash differences. 'Honey'n'Pearl' revealed significant potash differences, with the highest of total chlorophyll when no potash was applied, an intermediate at 45

Table 20. Chlorophyll b(ug/mg dry weight) in sweet corn at 15 and 32 days after planting in warm field soils with three potash levels and five cultivars.

	Days after planting	
Potash (kg/ha)	15	32
0	7.1 ± 3.3a[z,y]	7.4 ± 1.5a
45	6.1 ± 2.6ab	8.2 ± 1.5a
90	4.1 ± 6.0b	7.7 ± 1.7a
Cultivar		
Illini Gold	6.4 ± 0.7a[x]	7.8 ± 1.8ab
Florida Staysweet	5.9 ± 2.3a	8.3 ± 1.4a
Crisp'n'Sweet	7.2 ± 2.0a	7.9 ± 1.5ab
Honey'n'Pearl	6.4 ± 5.2a	6.9 ± 1.8b
How Sweet It Is	3.0 ± 7.2a	8.1 ± 1.2ab

[z] mean separation for lumped means within a column for all potash levels based on Duncan's multiple range at P=0.05.

[y] means are lumped because no significant interaction between cultivar and potash.

[x] mean separation for lumped means within a column for all cultivars based on Duncan's multiple range at P=0.05.

Table 21. Total chlorophyll (ug/mg dry weight) in sweet corn at 15, 32 and 49 days after planting in cold field soils with three potash levels and five cultivars.

	Days after planting		
Potash (kg/ha)	15	32	49
0	14.8±6.3a[z,y]	11.6±3.1a	14.1±2.0a
45	14.9±4.4a	13.1±2.7a	14.6±2.3a
90	14.5±3.0a	13.0±3.0a	14.8±1.9a
Cultivar			
Illini Gold	12.0±5.6b[x]	11.2±2.8a	12.9±2.7c
Florida Staysweet	15.2±3.6ab	14.6±2.6a	14.2±1.4bc
Crisp'n'Sweet	16.7±3.4a	12.3±3.4a	15.1±1.8ab
Honey'n'Pearl	-	11.9±2.3a	13.9±0.8bc
How Sweet It Is	-	12.7±2.8a	16.3±2.7a

[z] mean separation of lumped means within a column for all potash levels based on Duncan's multiple range at P=0.05.

[y] means are lumped because no significant interaction between cultivar and potash.

[x] mean separation of lumped means within a column for all cultivars based on Duncan's multiple range at P=0.05.

Table 22. Total chlorophyll(ug/mg dry weight) in sweet corn at 15 and 32 days after planting in warm field soils for three potash levels and five cultivars.

	Days after planting	
Potash (kg/ha)	15	32
0	14.4 ± 2.6a[z,y]	16.2 ± 2.8a
45	12.7 ± 3.8a	17.2 ± 3.0a
90	13.1 ± 4.4a	17.1 ± 2.5a
Cultivar		
Illini Gold	13.2 ± 1.2a[x]	16.7 ± 3.7a
Florida Staysweet	13.6 ± 2.0a	17.6 ± 2.7a
Crisp'n'Sweet	15.1 ± 2.0a	17.4 ± 2.6a
Honey'n'Pearl	12.7 ± 5.0a	17.0 ± 15.4a
How Sweet It Is	12.4 ± 5.8a	17.0 ± 2.1a

[z] mean separation for lumped means within a column for all potash levels based on Duncan's multiple range at P=0.05.

[y] means are lumped because no significant interaction between cultivar and potash.

[x] mean separation for lumped means within a column for all cultivars based on Duncan's multiple range at P=0.05.

kg/ha potash, and the lowest total chlorophyll at 90 kg/ha potash. Furthermore, significant differences between cultivars were revealed when no potash or 90 kg/ha of potash was applied. When no fertilizer was applied, 'How Sweet It Is' had more total chlorophyll than 'Illini Gold', 'Florida Staysweet','Crisp'n'Sweet' and 'How Sweet It Is' (Table 23). At 90 kg/ha potash, 'How Sweet It Is', 'Crisp'n'Sweet', 'Florida Staysweet' and 'Illini Gold' were more tolerant than 'Honey'n'Pearl' (Table 23).

Two-way analysis of variance for potassium content in plant tissue revealed no significant cultivar or potash differences at 49 days after planting in cold field soils (Appendix B; Table 24). No interaction between cultivar and potash was revealed. Two-way analysis of variance for potassium concentration in plant tissue revealed no significant cultivar or potash differences 32 days after planting in warm field soils (Appendix B; Table 24). No significant interaction between cultivar and potash was revealed.

Table 23. Total chlorophyll(ug/mg dry weight) in sweet corn at 15 days after planting in warm field soils at three potash levels for five cultivars.

	Potash (kg/ha)		
Cultivar	0	45	90
Illini Gold	14.1±1.5bw[z]	13.1±0.5aw	12.4±1.1aw
Florida Staysweet	12.7±3.0bw	13.6±1.3aw	14.5±1.4aw
Crisp'n'Sweet	14.6±2.1bw	15.7±2.7aw	14.9±1.4aw
Honey'n'Pearl	17.8±1.8bw	13.1±2.8ax	7.2±2.1by
How Sweet It Is	12.9±1.4aw	8.0±5.8aw	16.3±6.6aw

[z] ab to separate means within a column based on Duncan's multiple range at P=0.05; wxy to separate means within a row based on Duncan's multiple range at P=0.05.

Table 24. Potassium content (mg/g dry weight) in sweet corn seedlings at 49 days after the cold planting or 32 days after the warm planting with three potash levels and five cultivars.

	Days after planting	
Potash (kg/ha)	32(warm)	49(cold)
0	9.13 ± 2.01a[z,y]	10.32 ± 1.13a
45	9.04 ± 1.71a	11.28 ± 3.29a
90	9.13 ± 2.16a	11.00 ± 4.30a
Cultivar		
Illini Gold	9.40 ± 1.46a[x]	10.13 ± 1.37a
Florida Staysweet	9.67 ± 2.21a	10.98 ± 3.92a
Crisp'n'Sweet	8.00 ± 1.49a	11.63 ± 2.6a
Honey'n'Pearl	9.52 ± 2.55a	10.36 ± 2.16a
How Sweet It Is	9.00 ± 1.51a	11.23 ± 5.18a

[z] mean separation for lumped means within a column for all potash levels based on Duncan's multiple range at P=0.05.

[y] means are lumped because no significant interaction between cultivar and potash.

[x] mean separation for lumped means within a column for all cultivars based on Duncan's multiple range at P=0.05.

Growth chamber studies

Two-way analysis of variance for the number of seedlings emerged at 15^{0}C for both runs revealed significant cultivar differences but no potash effect (Appendix B). No significant interaction between cultivars and potash was revealed. For the first run, 'Illini Gold', 'Crisp'n'Sweet' and 'Florida Staysweet' had more plants emerged than 'Honey'n'Pearl' or 'How Sweet It Is' (Table 25). For the second run, 'Florida Staysweet', 'Crisp'n'Sweet' and 'Illini Gold' had the most plants emerged, 'Honey'n'Pearl' was intermediate, and 'How Sweet It Is' had the fewest plants emerged (Table 26). At 25^{0}C, for the first run, no significant cultivar or potash differences were revealed for the number of leaves (Table 27). However, during the second run at 25^{0}C, significant cultivar differences and no potash effect were revealed. 'Florida Staysweet', 'Illini Gold' and 'Crisp'n'Sweet' had the most emerged plants, 'Honey'n'Pearl' was intermediate, and 'How Sweet It Is' had the fewest plants emerged (Table 28).

Two-way analysis of variance for the number of leaves at 15^{0}C revealed significant cultivar differences and no potash effect (Appendix B). No significant interaction between cultivar and potash was revealed. For the first run, 'Illini Gold' had the most leaves, then 'Crisp'n'Sweet' and 'Florida Staysweet' followed by 'How Sweet It Is' and lastly 'Honey'n'Pearl' (Table 25). For the second run at 15^{0}C 'Florida Staysweet' had the most leaves, followed by 'Illini

Table 25. Number of plants emerged from 10 seeds, number of leaves and leaf area(cm^2) of sweet corn seedlings in growth chambers for 15 days at 15^0C with three potash levels and five cultivars (First run).

Potash (g)	# emerged	# leaves	leaf area
0	9.0±1.3a[z,y]	2.0±0.5a	5.95±2.81a
5	9.0±1.7a	2.0±0.5a	6.12±2.13a
10	9.0±1.5a	2.0±0.6a	5.05±2.29a
Cultivar			
Illini Gold	9.0±0.5a[x]	3.0±0.2a	7.15±3.19a
Florida Staysweet	9.0±0.7a	2.0±0.5ab	6.25±1.02ab
Crisp'n'Sweet	9.0±0.5a	2.0±0.4ab	6.67±2.21a
Honey'n'Pearl	8.0±1.2b	1.0±0.4c	4.17±1.70b
How Sweet It Is	7.0±1.9b	2.3±0.4b	4.32±2.15b

[z] mean separation of lumped means within a column for all potash levels based on Duncan's multiple range at P=0.05.

[y] means are lumped because no significant interaction between cultivar and potash.

[x] mean separation of lumped means within a column for all cultivars based on Duncan's multiple range at P=0.05.

Table 26. Number of plants emerged from 10 seeds, number of leaves, and leaf area(cm^2) of sweet corn seedlings in the growth chambers for 15 days at 15^0C with three potash levels and five cultivars (Second run)

Potash (g)	# emerged	# leaves	leaf area
0	$8.0\pm2.1a^{z,y}$	$2.0\pm0.5a$	$5.55\pm1.84a$
5	$8.0\pm2.4a$	$2.0\pm0.5a$	$5.44\pm2.18a$
10	$8.0\pm1.5a$	$2.0\pm0.40a$	$4.42\pm1.18a$
Cultivar			
Illini Gold	$9.0\pm0.4a^{x}$	$2.0\pm0.3ab$	$8.74\pm2.10ab$
Florida Staysweet	$9.0\pm0.5a$	$3.0\pm0.5a$	$8.24\pm1.59abc$
Crisp'n'Sweet	$9.3\pm0.7a$	$2.0\pm0.2ab$	$9.05\pm1.41a$
Honey'n'Pearl	$7.0\pm1.3b$	$1.0\pm0.4c$	$8.05\pm3.12bc$
How Sweet It Is	$5.0\pm1.5c$	$1.0\pm0.5c$	$5.66\pm3.11c$

^{z} mean separation of lumped means within a column for all potash levels based on Duncan's multiple range at P=0.05.

^{y} means are lumped because no significant interaction between cultivar and potash.

^{x} mean separation of lumped means within a column for all cultivars based on Duncan's multiple range at P=0.05.

Table 27. Number of plants emerged from 10 seeds, number of leaves and leaf area (cm^2) of sweet corn seedlings in growth chambers for 15 days at 25^0C with three potash levels and five cultivars (First run).

Potash (g)	# emerged	# leaves	leaf area
0	9.0±1.2a[z,y]	4.0±0.5a	12.67±4.03ab
5	10.0±0.6a	3.0±0.3ab	15.14±4.26a
10	9.0±3.5a	2.0±0.5b	11.16±4.08b
Cultivar			
Illini Gold	10.0±0.1a[x]	3.0±0.4a	13.82±3.11a
Florida Staysweet	10.0±3.1a	3.0±0.2a	14.18±3.56a
Crisp'n'Sweet	9.0±0.8a	3.0±0.2a	15.04±3.80a
Honey'n'Pearl	7.0±1.2a	2.0±0.5b	9.84±5.67b
How Sweet It Is	7.0±1.5a	3.0±0.4a	12.07±4.05ab

[z] mean separation of lumped means within a column for all potash levels based on Duncan's multiple range at P=0.05.

[y] means are lumped because no significant interaction between cultivar and potash.

[x] mean separation of lumped means within a column for all cultivars based on Duncan's multiple range at P=0.05.

Table 28. Number of plants emerged from 10 seeds, number of leaves and leaf area (cm^2) of sweet corn seedlings in growth chambers for 15 days at 25^0C with three potash levels and five cultivars (Second run).

Potash (g)	# emerged	# leaves	leaf area
0	$9.0\underline{+}1.8a^{z,y}$	$3.0\underline{+}0.3a$	$17.84\underline{+}4.51a$
5	$9.0\underline{+}1.8a$	$3.0\underline{+}0.2a$	$19.04\underline{+}5.08a$
10	$9.0\underline{+}1.3a$	$3.0\underline{+}0.2a$	$13.97\underline{+}6.83b$
Cultivar			
Illini Gold	$10.0\underline{+}0.7a^{x}$	$3.0\underline{+}0.3a$	$21.78\underline{+}2.88a$
Florida Staysweet	$10.0\underline{+}0.3a$	$3.0\underline{+}0.2a$	$15.51\underline{+}6.15bc$
Crisp'n'Sweet	$9.0\underline{+}1.0a$	$3.0\underline{+}0.1a$	$19.36\underline{+}3.76ab$
Honey'n'Pearl	$8.0\underline{+}1.0b$	$3.1\underline{+}0.3a$	$15.24\underline{+}6.90bc$
How Sweet It Is	$6.0\underline{+}1.5c$	$3.0\underline{+}0.2a$	$12.97\underline{+}4.88c$

[z] mean separation for lumped means within a column for all potash levels based on Duncan's multiple range at P=0.05.

[y] means are lumped because no significant interaction between cultivar and potash.

[x] mean separation for lumped means within a column for all cultivars based on Duncan's multiple range at P=0.05.

Gold' then 'Crisp'n'Sweet' and lastly 'Honey'n'Pearl' and 'How Sweet It Is' (Table 26). At 25^{0}C, significant cultivar and potash differences were revealed only for the first run. No significant interaction between cultivar and potash was revealed, although no significance for the second run. All cultivars had more leaves than 'Honey'n'Pearl' (Table 27). At the same time, leaf numbers were greatest when no potash was applied, intermediate with 5g potash and least with 10g potash.

Two-way analysis of variance for leaf area at 15^{0}C for both runs, revealed significant cultivar differences but no potash effect (Appendix B). No significant interaction between cultivar and potash was revealed for either runs. For the first run, 'Illini Gold' and 'Crisp'n'Sweet' had the most leaf area, 'Florida Staysweet' was intermediate and then 'Honey'n'Pearl' and 'How Sweet It Is' had the least leaf area (Table 25). For the second run, 'Crisp'n'Sweet' had the greatest leaf area followed by 'Illini Gold' then 'Florida Staysweet' and finally 'Honey'n'Pearl' and then 'How Sweet It Is' (Table 26). At 25^{0}C for both runs, significant cultivar and potash differences were revealed (Appendix B). No significant interaction was revealed for either run. For the first run, 'Crisp'n'Sweet', 'Florida Staysweet' and 'Illini Gold' had the greatest leaf area, ' How Sweet It Is' was intermediate, and 'Honey'n'Pearl' had the least leaf area (Table 27). At the same time, leaf area was greatest with 5g

potash, intermediate with no potash, and least with 10g potash (Table 27). For the second run, 'Illini Gold' had the greatest leaf area, then 'Crisp'n'Sweet', then 'Florida Staysweet' and 'Honey'n'Pearl', lastly 'How Sweet It Is' had (Table 28). At the same time, leaf area was greatest with no potash or 5g potash compared to 10 g potash (Table 28).

Two way analysis of variance for height of seedlings at 15^0C for both runs, revealed significant cultivar differences but no potash effect (Appendix B). No significant interaction between cultivar and potash was revealed for either run. For the first run, 'Crisp'n'Sweet' had the tallest plants, followed by 'Florida Staysweet', 'Illini Gold' and 'Honey'n'Pearl', and then 'How Sweet It Is' (Table 29). For the second run, 'Crisp'n'Sweet' had the tallest plants followed by 'Florida Staysweet', 'Illini Gold', 'Honey'n'Pearl' and then 'How Sweet It Is' (Table 30). At 25^0C, for both runs, significant cultivar differences and no potash effect were revealed (Appendix B). No significant interaction between cultivar and potash was revealed for either run. For the first run, 'Crisp'n'Sweet' had the tallest plants followed by 'Florida Staysweet' and 'Illini Gold' and 'How Sweet It Is' and then 'Honey'n'Pearl' had the shortest plants (Table 31). For the second run, 'Crisp'n'Sweet' had the tallest plants followed by 'Florida Staysweet', 'Illini Gold' and 'How Sweet It Is' and then 'Honey'n'Pearl' had the shortest plants (Table 32).

Table 29. Height(cm), fresh weight (g) and dry weight(g) of sweet corn seedlings in growth chambers for 15 days at 15^{0}C with three potash levels and five cultivars (First run).

Potash (g)	Height	Fwt	Dwt
0	6.7±1.6a[z,y]	0.18±0.06a	0.02±0.01a
5	6.6±2.0a	0.21±0.10a	0.02±0.01a
10	6.0±2.0a	0.19±0.08a	0.02±0.01a
Cultivar			
Illini Gold	6.3±1.5bc[x]	0.22±0.04a	0.02±0.00a
Florida Staysweet	7.1±1.0ab	0.22±0.03a	0.02±0.00a
Crisp'n'Sweet	8.2±1.3a	0.26±0.09a	0.03±0.01a
Honey'n'Pearl	5.6±2.0bc	0.12±0.06b	0.01±0.01b
How Sweet It Is	5.3±1.5c	0.13±0.07b	0.01±0.01b

[z] mean separation of lumped means within a column for all potash levels based on Duncan's multiple range at P=0.05.

[y] means are lumped because no significant interaction between cultivar and potash.

[x] mean separation of lumped means within a column for all cultivars based on Duncan's multiple range at P=0.05.

Table 30. Height (cm), fresh weight (g) and dry weight (g) of sweet corn seedlings in growth chambers for 15 days at 15^{0}C with three potash levels and five cultivars (Second run).

Potash (g)	Height	Fwt	Dwt
0	4.6±1.2a[z,y]	0.17±0.05a	0.02±0.01a
5	4.9±1.5a	0.18±0.07a	0.02±0.01a
10	4.7±1.1a	0.17±0.04a	0.02±0.00a
Cultivar			
Illini Gold	4.8±0.8b[x]	0.18±0.05ab	0.02±0.00a
Florida Staysweet	5.2±0.9ab	0.20±0.05a	0.02±0.00a
Crisp'n'Sweet	6.0±1.2a	0.21±0.06a	0.02±0.01a
Honey'n'Pearl	3.7±0.8bc	0.14±0.04b	0.01±0.00b
How Sweet It Is	3.7±1.0c	0.14±0.04b	0.01±0.00b

[z] mean separation of lumped means within a column for all potash levels based on Duncan's multiple range at P=0.05.

[y] means are lumped because no significant interaction between cultivar and potash.

[x] mean separation of lumped means within a column for all cultivars based on Duncan's multiple range at P=0.05.

Table 31. Height(cm), fresh weight (g) and dry weight(g) of sweet corn seedlings in growth chambers for 15 days, at 25^{0}C with three potash levels and five cultivars (First run).

Potash (g)	Height	Fwt	Dwt
0	14.3±4.4a[z,y]	0.44±0.19b	0.04±0.02ab
5	15.6±5.5a	0.58±0.22a	0.05±0.02a
10	17.8±5.6a	0.38±0.15b	0.03±0.02b
Cultivar			
Illini Gold	15.2±3.3ab[x]	0.50±0.13ab	0.04±0.01ab
Florida Staysweet	18.2±4.8ab	0.54±0.20a	0.05±0.02a
Crisp'n'Sweet	18.8±4.0a	0.57±0.21a	0.06±0.02a
Honey'n'Pearl	9.3±2.9c	0.37±0.24b	0.02±0.02c
How Sweet It Is	14.4±4.6b	0.36±0.16b	0.03±0.01bc

[z] mean separation for lumped means within a column for all potash levels based on Duncan's multiple range at P=0.05.

[y] means are lumped because no significant interaction between cultivar and potash.

[x] mean separation for lumped means within a column for all cultivars based on Duncan's multiple range at P=0.05.

Table 32. Height(cm), fresh weight (g) and dry weight(g) of sweet corn seedlings in growth chambers for 15 days at 25^{0}C with three potash levels and five cultivars (Second run).

Potash (g)	Height	Fwt	Dwt
0	17.4±4.5a[z,y]	0.54±0.14a	0.05±0.02ab
5	17.5±3.6a	0.60±0.15a	0.06±0.02a
10	16.3±4.2a	0.48±0.18a	0.04±0.02b
Cultivar			
Illini Gold	17.2±3.2b[x]	0.60±0.12ab	0.07±0.02a
Florida Staysweet	17.9±3.3ab	0.55±0.14abc	0.06±0.02ab
Crisp'n'Sweet	20.8±2.4a	0.63±0.11a	0.07±0.01a
Honey'n'Pearl	12.7±4.6c	0.48±0.17bc	0.04±0.02b
How Sweet It Is	16.7±2.3b	0.44±0.19c	0.04±0.02b

[z] mean separation for lumped means within a column for all potash based on Duncan's multiple range at P=0.05.

[y] means are lumped because no significant interaction between cultivar and potash.

[x] mean separation for lumped means within a column for all cultivars based on Duncan's multiple range at P=0.05.

Two-way analysis of variance for fresh weight at 15^{0}C, for both runs, revealed significant cultivar differences but no potash effect (Appendix B). No significant interaction between cultivar and potash was revealed for both runs. For the first run, 'Crisp'n'Sweet', 'Illini Gold' and 'Florida Staysweet' had greater fresh weights than 'How Sweet It Is' and 'Honey'n'Pearl' (Table 29). For the second run, 'Crisp'n'Sweet' and 'Florida Staysweet' had the greatest fresh weights, 'Illini Gold' was intermediate, and 'How Sweet It Is' and 'Honey'n'Pearl' had the least fresh weights (Table 30). At 25^{0}C, for both runs, significant cultivar differences were revealed (Appendix B). Significant potash differences were revealed only for the first run. For the first run, 'Crisp'n'Sweet' and 'Florida Staysweet' had the greatest fresh weights, 'Illini Gold' was intermediate and then 'Honey'n'Pearl' and 'How Sweet It Is' had the least fresh weights (Table 31). For the second run, 'Crisp'n'Sweet' had the greatest fresh weight, followed by 'Illini Gold', 'Florida Staysweet', 'Honey'n'Pearl' and 'How Sweet It Is' (Table 32). Fresh weight was greater when 5g of potash was applied, and less when no potash or 10g potash was applied (Table 31).

Two-way analysis of variance for dry weight at 15^{0}C for both runs revealed significant cultivar differences but no potash effect (Appendix B). No significant interaction between cultivar and potash was revealed for either run. For first run, 'Crisp'n'Sweet ', 'Florida Staysweet' and 'Illini

Gold' had greater dry weights than 'How Sweet It Is' and 'Honey'n'Pearl' (Tables 29 and 30). At 25^0C for either run significant cultivar differences were revealed. For the first run, 'Crisp'n'Sweet' and 'Florida Staysweet' had the greatest dry weights, followed by 'Illini Gold' then 'How Sweet It Is' and then 'Honey'n'Pearl' (Table 31). For the second run, 'Illini Gold' and 'Crisp'n'Sweet' had the greatest dry weights, 'Florida Staysweet' was intermediate and 'How Sweet It Is' and 'Honey'n'Pearl' had the least dry weights (Table 32).

Two-way analysis of variance for chlorophyll a at 15^0C, for both runs, revealed no significant cultivar differences (Appendix B). Significant potash differences were revealed for the first run. No significant interaction between cultivar and potash was revealed for both runs. When no potash or 5g potash was applied, chlorophyll a was higher than when 10g potash was applied (Table 33). At 25^0C, for both runs, no significant cultivar or potash differences were revealed (Appendix B, Tables 35 and 36). No significant interaction between cultivar and potash was revealed.

Two-way analysis of variance for chlorophyll b at 15^0C, for the first run revealed no significant cultivar or potash differences (Appendix B; Table 33). Significant cultivar differences but no potash effect were revealed during the second run. No significant interactions were revealed for both runs. All cultivars had higher concentrations of chlorophyll

Table 33. Chlorophyll a, chlorophyll b and total chlorophyll (ug/mg dry weight) of sweet corn seedlings in growth chambers for 15 days at 15^0C with three potash levels and five cultivars (First run).

Potash (g)	Chl a	Chl b	Total Chl
0	10.1±1.6a[z,y]	9.4±2.6a	19.6±52.5a
5	9.6±1.8a	8.9±1.6a	18.6± 3.1a
10	7.8±2.5b	8.1±3.2a	15.9± 5.2a
Cultivar			
Illini Gold	8.7±1.4a[x]	8.6±1.6a	17.1±2.8a
Florida Staysweet	9.9±1.4a	8.9±0.9a	18.6±7.9a
Crisp'n'Sweet	9.4±3.0a	9.1±3.0a	18.4±5.8a
Honey'n'Pearl	8.4±2.1a	7.3±3.3a	15.8±4.9a
How Sweet It Is	9.6±2.7a	10.3±2.6a	19.9±4.2a

[z] mean separation of lumped means within a column for all potash levels based on Duncan's multiple range at P=0.05.

[y] means are lumped because no significant interaction between cultivar and potash.

[x] mean separation of lumped means within a column for all cultivars based on Duncan's multiple range at P=0.05.

b than 'How Sweet It Is' (Table 34). At 25^{0}C, for the first run no significant cultivar or potash differences were revealed (Appendix B; Table 35). No significant interactions between cultivar and potash were revealed for both runs. Significant cultivar differences were revealed during the second run. No significant interactions between cultivar and potash were revealed. For the second run, 'How Sweet It Is' had the highest concentrations of chlorophyll b, 'Honey'n'Pearl' and 'Crisp'n'Sweet' were intermediate, and then 'Florida Staysweet' and 'Illini Gold' had the lowest concentrations of chlorophyll b (Table 36).

Two-way analysis of variance for total chlorophyll, at 15^{0}C for both runs revealed no significant potash effects (Appendix B; Tables 33 and 34). No interactions between cultivar and potash were revealed for either run. Significant cultivar differences were revealed during the second run. 'Crisp'n'Sweet', 'Illini Gold', and 'Florida Staysweet' had higher concentrations of total chlorophyll than 'Honey'n'Pearl' or 'How Sweet It Is' (Table 34). At 25^{0}C for the first run, no significant cultivar or potash differences were revealed (Appendix B; Table 35). Significant cultivar differences but no potash differences were revealed during the second run (Appendix B). No significant interactions were revealed for either run. 'How Sweet It Is' had the highest total chlorophyll concentrations, 'Honey'n'Pearl' and 'Crisp'n'Sweet' were intermediate, and

Table 34. Chlorophyll a, chlorophyll b and total chlorophyll (ug/mg dry weight) seedlings of sweet corn in growth chambers for 15 days at 15^{0}C with three potash levels and five cultivars (Second run).

Potash (g)	Chl a	Chl b	Total Chl
0	8.1±2.7a[z,y]	7.7±1.5a	15.8±3.8a
5	8.1±3.0a	7.7±2.4a	15.8±5.0a
10	7.6±2.1a	7.7±1.7a	12.3±3.2a
Cultivar			
Illini Gold	8.7±2.1a[x]	8.5±1.5a	17.2±2.4a
Florida Staysweet	8.2±1.6a	8.3±1.2a	16.5±2.5a
Crisp'n'Sweet	9.1±1.4a	8.4±0.9a	17.5±2.0a
Honey'n'Pearl	8.1±3.1a	7.9±0.6a	6.0±5.1b
How Sweet It Is	6.0±3.1a	5.2±2.5b	10.9±5.1b

[z] mean separation of lumped means within a column for all potash levels based on Duncan's multiple range at P=0.05.

[y] means are lumped because no significant interaction between cultivar and potash.

[x] mean separation of lumped means within a column for all cultivars based on Duncan's multiple range at P=0.05.

Table 35. Chlorophyll a, chlorophyll b and total chlorophyll (ug/mg dry weight) of sweet corn seedlings in growth chambers for 15 days at 25^{0}C with three potash levels and five cultivars(First run).

Potash (g)	Chl a	Chl b	Total Chl
0	8.0±2.3a[z,y]	7.5±2.8a	15.5±5.0a
5	6.9±2.7a	6.3±2.4a	13.1±5.1a
10	6.7±1.5a	6.1±1.5a	12.7±2.9a
Cultivar			
Illini Gold	6.3±0.8a[x]	5.6±1.0a	11.9±1.7a
Florida Staysweet	7.2±2.8a	6.8±2.6a	14.1±5.4a
Crisp'n'Sweet	7.2±1.8a	6.7±1.6a	13.8±3.3a
Honey'n'Pearl	6.6±2.0a	5.7±2.2a	12.2±4.1a
How Sweet It Is	8.6±2.9a	8.3±3.2a	16.7±5.9a

[z] mean separation of lumped means within a column for all potash levels based on Duncan's multiple range at P=0.05.

[y] means are lumped because no significant interaction between cultivar and potash.

[x] mean separation of lumped means within a column for all cultivars based on Duncan's multiple range at P=0.05.

Table 36. Chlorophyll a, chlorophyll b and total chlorophyll (ug/ mg dry weight) of sweet corn seedlings in growth chambers for 15 days at 25^{0}C with three potash levels and five cultivars (Second run).

Potash (g)	Chl a	Chl b	Total Chl
0	5.3±2.0a[z,y]	4.7±1.6a	10.0±3.6a
5	5.8±2.8a	4.9±2.5a	10.8±4.7a
10	4.7±1.4a	4.3±1.3a	8.9±2.6a
Cultivar			
Illini Gold	4.1±1.3a[x]	3.7±1.3b	7.7±2.6b
Florida Staysweet	5.0±2.8a	3.7±1.3b	8.7±3.2b
Crisp'n'Sweet	5.2±1.3a	4.7±1.1ab	9.9±2.2ab
Honey'n'Pearl	5.4±1.4a	4.9±1.3ab	10.3±2.7ab
How Sweet It Is	6.7±2.9a	6.2±2.7a	13.0±5.5a

[z] mean separation of lumped means within a column for all potash levels based on Duncan's multiple range at P=0.05.

[y] means are lumped because no significant interaction between cultivar and potash.

[x] mean separation of lumped means within a column for all cultivars based on Duncan's multiple range at P=0.05.

'Florida Staysweet' and 'Illini Gold' had the lowest concentrations of total chlorophyll (Table 36). No significant interaction between cultivar and potash was revealed.

Soluble solids at both 15 and 25^{0}C for both runs varied little ranging between 25.5 and 25.7^0 Brix.

CHAPTER 5

DISCUSSION

In this study, emergence of five different supersweet corn cultivars with low temperature at different potash levels was investigated. Generally, most environmental factors that affect emergence are also related to seed germination. This association is because a seed germinates prior to emergence. Adverse effects on germination or emergence may result in decreased plant growth. For this reason, emergence along with other growth parameters were investigated in this study to understand clearly the interactions of potassium and low temperature on emergence of supersweet corn cultivars.

One theory of this study, was that low soil temperature retards germination of supersweet corn, thus resulting in poor emergence and nonuniform stands. Soil temperature is particularly important for germination of corn and has an influence on the early growth of a crop (Iremiren, 1988). In this investigation low temperature of field soils and growth chambers decreased the number of sweet corn plants that ultimately emerged during the cold growing period compared to the higher temperatures. During the cold period in the field, soil temperature was below optimal for germination of sweet corn which is between 20 and 25^0C (Swiader and Gerber, 1984). Hence, poor stands were observed for the cold planting. In addition to the low numbers of plants that ultimately emerged in the field, the time required for plants to emerge during

the warm period was less compared to that of the cold period. Also, all parameters measured for the warm period were relatively higher than those of the cold period, both in the growth chamber and field plots. Low temperature had an influence on plant development by delaying emergence. This delay supports the hypothesis that supersweet corn types are sensitive to low temperature.

Another theory of this investigation was that different cultivars of supersweet corn have different responses to temperature, suggesting genetic control for temperature tolerance. In experiments conducted in this investigation, both in the field and growth chamber, significant cultivar differences were observed. 'Illini Gold', 'Florida Staysweet' and 'Crisp'n'Sweet' showed tolerance to low temperature compared to 'Honey'n'Pearl' and 'How Sweet It Is'. This response was observed for most parameters measured. Although significant differences among these three tolerant cultivars were minimal, 'Crisp'n'Sweet' was more tolerant in most cases. 'How Sweet It Is' was relatively sensitive compared to all other cultivars in most cases, but it was tolerant based on chlorophyll concentrations, particularly total chlorophyll. This higher concentration in chlorophyll, in combination with other uninvestigated elements may be an adaptive mechanism for this cultivar to survive by increasing its photosynthetic capacity under low temperatures. Although 'Honey'n'Pearl' was another sensitive cultivar, this response with chlorophyll was

not observed. Perhaps 'Honey'n'Pearl has a different mechanism to survive cold temperatures that possibly was not measured in this investigation. This difference in response of supersweet corn cultivars to low temperature suggests genetic control for temperature tolerance.

Heights, leaf area, number of plants emerged, fresh weight and dry weight showed more cultivar differences to low temperature with different potash levels than soluble solids and chlorophyll concentration. Although leaf area, fresh weight and dry weight were good indicators of cold tolerance, they are time consuming to measure. However, stand count, height and number of leaves can be obtained immediately and are less time consuming to measure, especially in the field.

Genetic control also plays a role in response of different cultivars to potassium. Potassium is an essential element required in large amounts by plants. Very low potassium in soils causes deficiency for plants, whereas very high potassium in soils can be toxic depending on requirements of that plant. However, plants respond better to a moderate supply of potassium in soils than low or high potassium supply. In experiments conducted in growth chamber and field plots, very little potassium effect was observed, except for the warm planting. Low temperatures may have decreased potassium uptake due to impermeability of membranes or inactivation of enzymes with low temperatures (Hartman et. al., 1988). Based on this study and other studies done,

application of potassium as a means of improving germination with low temperatures, becomes less effective if both soil moisture and soil temperature are low. When conditions were relatively wet during the cold period in the field, plant responses to different fertilizer levels were not significant. Even though fertilizer effects were minimal, some response was observed with 45 kg/ha potash in the field experiments at 48 days after the warm planting or 49 days after the cold planting. Control plants responded better compared to 90 kg/ha potash, suggesting possible toxicity at this high potash level. Occurrence of potash effects at later sampling days could be due to the fact that potassium becomes more critical at reproductive stages of plants than seedlings. Unfortunately, this stage associated response of plants to potassium cannot be concluded by this investigation since only the seedling stage was of interest. Furthermore, when no potash or 45 kg/ha potash was applied, 'Illini Gold', 'Florida Staysweet' and 'Crisp'n'Sweet' had increased growth compared to 90 kg/ha potash. 'How Sweet It Is' grew better at 90 kg/ha potash than at other potash levels. 'How Sweet It Is' demonstrated more tolerance to high potash levels than the other cultivars. The limited potash effect observed in field experiments could be due to high residual potassium amounts in the soil prior to potash applications. High residual potassium was shown by soil tests in the soil and might have been enough for seedling requirements for growth, such that added

potassium was insignificant. The use of sandy soil that is normally poor in potassium, might have shown a potassium effect. Also, growth chamber studies using vermiculite did not show a significant potash effect. Possibly, seedlings absorbed potassium and stored the excess as luxury consumption. This response further suggests that potassium may be critical to plants older than 2 weeks. Generally in growth chambers, most parameters were increased with 5 g potash as compared to 0 or 10 g potash. This increase suggests that moderate levels of potash improved, growth and different cultivars responded differently to fertilizer levels.

One hypothesis of this investigation to test whether growth chamber results would be comparable to field plot results. In this study the two were similar in most cases for both temperatures. Whenever significant cultivar differences were observed in growth chambers, the same was true for field plots within a similar temperature. However comparisons of fertilizer effects were less similar. In the growth chamber, factors such as temperature, moisture and relative humidity were controlled whereas in the field they were not. Thus, growth chamber and field results may not be comparable. Also, experimental error(s) involved in both growth chamber and field plots are potential sources of differences in results. To compare growth chamber and field plot studies more successfully, a series of field studies over a period of at least 3 years should be completed with consistent duplications

of field and growth chamber studies. Importance of repeating field studies becomes even more important due to weather fluctuations associated with fields from year to year. For example, during the warm planting for this experiment, the planting date was much later due to high rainfall during that time. Also, a rapid decline in rainfall occurred immediately after the planting. Consequently, stands 15 days after the warm planting were less uniform than for the cold planting. Therefore, a single set of data from field studies is less reliable than three or four sets of data.

For future studies, measurement of fewer parameters such as stand count, heights and number of leaves are suggested especially if a large number of samples is involved. Fewer parameters limit errors involved with handling lots of data, and allows enough time to repeat studies if necessary. Furthermore, to understand the stage of growth when potassium is most critical, a study from emergence past the silking stage of sweet corn is suggested.

CONCLUSIONS

The question is, can potash be used to overcome stand establishment problems with supersweet corn in cold soils? Possibly application of about 45 kg/ha potash on cold soils with poor potassium content may improve emergence of supersweet corn cultivars. 'Crisp'n'Sweet', 'Illini Gold' and 'Florida Staysweet' were the best emergers low temperatures under moderate potassium levels on humic soils.

'Honey'n'Pearl' and 'How Sweet It Is' were the most sensitive even though the later accumulated more chlorophyll and grew better with 90 kg/ha potash than the other cultivars.

APPENDIX A
PRELIMINARY STUDY

One preliminary study was done in growth chambers to determine levels of potash per tray to use in actual experiments. Five cultivars of sweet corn with five different levels of potash were used.

Plants were grown in two growth chambers, at 15 and 25^{0}C. For each temperature, five plastic trays (6 x 22 x 30 cm) were filled with vermiculite and mixed with either 0, 0.5, 10, 25, or 50 g potash. In each tray, 10 seeds of each cultivar were planted into five widely spaced rows. Plants were watered with distilled water every other day. Experiments were terminated after two weeks. Five parameters (number emerged, height, number of leaves, fresh weight and dry weight) were measured.

Based on the results presented in tables A1-A5 three potash levels 0, 5 and 10 g were chosen so that both intermediate (5g) and high (10 g) potassium effects could be observed relative to controls (0 g).

Table A1. Number of sweet corn plants emerged from 10 seeds in growth chambers at either 15 or 25^{0}C for 15 days with five levels of potash and five cultivars.

	Potash (g)				
Cultivar	0	0.5	10	25	50
			15^{0}C		
Illini Gold	9	10	10	6	-
Florida Staysweet	9	10	9	10	-
Crisp'n'Sweet	9	9	6	10	-
Honey'n'Pearl	4	3	6	2	-
How Sweet It Is	7	7	8	2	-
			25^{0}C		
Illini Gold	9	9	10	10	9
Florida Staysweet	10	10	9	10	-
Crisp'n'Sweet	9	10	10	10	3
Honey'n'Pearl	4	8	4	5	-
How Sweet It Is	4	6	7	2	6

Table A2. Number of leaves on sweet corn seedlings in growth chambers at either 15 or 25^{0}C for 15 days with five levels of potash and five cultivars.

	Potash (g)				
Cultivar	0	0.5	10	25	50
			15^{0}C		
Illini Gold	3.0±0.6	3.0±0.6	3.0±0.6	2.0±0.0	-
Florida Staysweet	3.0±0.6	3.0±0.6	2.0±0.0	2.0±0.6	-
Crisp'n'Sweet	2.0±0.0	3.0±0.6	2.0±0.0	2.0±0.0	-
Honey'n'Pearl	1.0±0.3	1.0±0.6	1.0±0.6	1.0±0.6	-
How Sweet It Is	3.0±0.6	2.0±0.6	2.0±0.6	-	-
			25^{0}C		
Illini Gold	4.0±0.0	4.0±0.0	4.0±0.6	2.0±0.0	2.0±0.0
Florida Staysweet	4.0±0.6	4.0±0.6	4.0±0.6	2.0±0.6	-
Crisp'n'Sweet	4.0±0.0	3.0±0.0	3.0±0.0	2.0±0.6	-
Honey'n'Pearl	3.0±0.6	3.0±0.6	2.0±0.6	1.0±0.6	-
How Sweet It Is	3.0±0.6	3.0±0.6	3.0±0.6	1.0±1.5	2.0±0.6

Table A3. Fresh weight (g) of sweet corn seedlings in growth chambers at either 15 or 25^{0}C for 15 days with five levels of potash and five cultivars.

	Potash (g)				
Cultivar	0	0.5	10	25	50
			15^{0}C		
Illini Gold	0.156	0.199	0.180	0.109	-
Florida Staysweet	0.147	0.163	0.127	0.082	-
Crisp'n'Sweet	0.194	0.160	0.149	0.105	-
Honey'n'Pearl	0.014	0.056	0.067	0.037	-
How Sweet It Is	0.117	0.057	0.127	0.002	-
			25^{0}C		
Illini Gold	0.491	0.640	0.580	0.219	0.109
Florida Staysweet	0.504	0.629	0.713	0.169	-
Crisp'n'Sweet	0.685	0.630	0.412	0.146	0.007
Honey'n'Pearl	0.577	0.534	0.252	0.050	-
How Sweet It Is	0.255	0.241	0.293	0.070	0.006

Table A4. Dry weight (g) of sweet corn seedlings in growth chambers at either 15 or 25^{0}C for 15 days with five levels of potash and five cultivars.

	Potash (g)				
Cultivar	0	0.5	10	25	50
			15^{0}C		
Illini Gold	0.02	0.02	0.02	0.01	-
Florida Staysweet	0.02	0.02	0.01	0.01	-
Crisp'n'Sweet	0.02	0.02	0.02	0.01	-
Honey'n'Pearl	0.00	0.01	0.01	0.01	-
How Sweet It Is	0.01	0.01	0.01	0.01	-
			25^{0}C		
Illini Gold	0.07	0.08	0.07	0.03	0.02
Florida Staysweet	0.08	0.07	0.09	0.02	-
Crisp'n'Sweet	0.10	0.09	0.05	0.02	-
Honey'n'Pearl	0.07	0.05	0.02	0.01	-
How Sweet It Is	0.03	0.03	0.04	0.01	0.01

Table A5. Height (cm) of sweet corn seedlings in growth chambers at either 15 or 25^{0}C for 15 days with five levels of potash and five cultivars.

	Potash (g)				
Cultivar	0	0.5	10	25	50
			15^{0}C		
Illini Gold	4.4±0.8	4.8±0.6	4.8±1.2	4.1±0.3	-
Florida Staysweet	5.2±1.0	3.6±0.4	4.4±1.0	3.4±0.4	-
Crisp'n'Sweet	8.0±1.0	3.9±0.4	5.2±0.9	3.5±0.2	-
Honey'n'Pearl	1.4±0.8	3.6±1.5	3.1±1.7	1.8±1.8	-
How Sweet It Is	4.1±1.0	4.0±1.4	5.3±1.9	0.3±0.3	-
			25^{0}C		
Illini Gold	10.4±0.9	12.7±0.8	13.7±4.1	7.8±2.6	3.8±2.3
Florida Staysweet	16.5±2.5	16.7±9.3	17.4±9.8	5.6±3.2	-
Crisp'n'Sweet	17.5±3.8	25.3±3.9	15.5±7.8	6.6±0.8	0.4±0.8
Honey'n'Pearl	17.2±9.5	15.9±2.6	12.5±3.6	3.9±2.1	-
How Sweet It Is	17.3±4.0	13.2±9.6	15.0±3.6	2.8±3.6	4.7±1.1

APPENDIX B
ANOVA TABLES

Table B1 (a) Two-way ANOVA randomized complete blocks - number of sweet corn plants emerged 15 days after planting in cold field soils.

Source	SS	df	MS	F	P
Blocks	50.983333333	3	16.994444444	1.5695228322	.2110 ns
Main Effects					
fert	3.1	2	1.55	0.1431503335	.8670 ns
cult	943.93333333	4	235.98333333	21.794253463	.0000 ***
Interaction					
fert x cult	86.066666667	8	10.758333333	0.9935864546	.4550 ns
Error	454.76666667	42	10.827777778		
Total	1538.85	59			

Table B1 (b) Two-way ANOVA randomized complete blocks - number of sweet corn plants emerged 32 days after planting in cold field soils.

Source	SS	df	MS	F	P
Blocks	70.533333333	3	23.511111111	2.9926255177	.0415 *
Main Effects					
fert	6.4333333333	2	3.2166666667	0.4094352965	.6666 ns
cult	2245.5666667	4	561.39166667	71.45706637	.0000 ***
Interaction					
fert x cult	77.233333333	8	9.6541666667	1.2288362461	.3064 ns
Error	329.96666667	42	7.8563492063		
Total	2729.7333333	59			

Table B1 (c) Two-way ANOVA randomized complete blocks - number of sweet corn plants emerged 49 days after planting in cold field soils.

Source	SS	df	MS	F	P
Blocks	52.452645	3	17.484215	1.7782192469	.1660 ns
Main Effects					
fert	4.5527633333	2	2.2763816667	0.2315177257	.7943 ns
cult	2218.9805267	4	554.74513167	56.419946236	.0000 ***
Interaction					
fert x cult	67.626053333	8	8.4532566667	0.8597322616	.5572 ns
Error	412.96203	42	9.8324292857		
Total	2756.5740183	59			

Table B2 (a) Two-way ANOVA randomized complete blocks-number of sweet corn plants emerged 15 days after planting in warm field soils.

Source	SS	df	MS	F	P	
Blocks	36.058333333	3	12.019444444	1.4077512534	.2539	ns
Main Effects						
fert	4.2583333333	2	2.1291666667	0.2493740087	.7804	ns
cult	179.45208333	4	44.863020833	5.254483608	.0016	**
Interaction						
fert x cult	116.49166667	8	14.561458333	1.7054790939	.1255	ns
Error	358.59791667	42	8.5380456349			
Total	694.85833333	59				

Table B2 (b) Two-way ANOVA randomized complete blocks-number of sweet corn plants emerged 32 days after planting in warm field soils.

Source	SS	df	MS	F	P	
Blocks	39.237833333	3	13.079277778	2.0622056989	.1197	ns
Main Effects						
fert	1.9063333333	2	0.9531666667	0.1502854948	.8609	ns
cult	2042.546	4	510.6365	80.511899682	.0000	***
Interaction						
fert x cult	116.892	8	14.6115	2.3037907047	.0380	*
Error	266.37966667	42	6.3423730159			
Total	2466.9618333	59				

Table B2 (c) Two-way ANOVA randomized complete blocks-number of sweet corn plants emerged 48 days after planting in warm field soils.

Source	SS	df	MS	F	P	
Blocks	34.117833333	3	11.372611111	1.6608143959	.1900	ns
Main Effects						
fert	1.6163333333	2	0.8081666667	0.1180216945	.8890	ns
cult	2098.6293333	4	524.65733333	76.619031779	.0000	***
Interaction						
fert x cult	138.59866667	8	17.324833333	2.5300550881	.0241	*
Error	287.59966667	42	6.8476111111			
Total	2560.5618333	59				

Table B3 (a) Two-way ANOVA randomized complete blocks- height of sweet corn plants 15 days after planting in cold field soils.

Source	SS	df	MS	F	P
Blocks	3.6911666667	3	1.2303888889	2.050539654	.1214 ns
Main Effects					
fert	0.3053333333	2	0.1526666667	0.2544309825	.7765 ns
cult	30.783333333	4	7.6958333333	12.82571028	.0000 ***
Interaction					
fert x cult	9.2646666667	8	1.1580833333	1.9300367705	.0806 ns
Error	25.201333333	42	0.600031746		
Total	69.245833333	59			

Table B3 (b) Two-way ANOVA randomized complete blocks - height of sweet corn plants 32 days after planting in cold field soils.

Source	SS	df	MS	F	P
Blocks	13.137333333	3	4.3791111111	1.5138581753	.2249 ns
Main Effects					
fert	3.139	2	1.5695	0.5425759579	.5853 ns
cult	76.817666667	4	19.204416667	6.6389644917	.0003 ***
Interaction					
fert x cult	45.489333333	8	5.6861666667	1.9657071209	.0750 ns
Error	121.49266667	42	2.8926825397		
Total	260.076	59			

Table B3 (c) Two-way ANOVA randomized complete blocks- height of sweet corn plants 49 days after planting in cold field soils.

Source	SS	df	MS	F	P
Blocks	155.89058667	3	51.963528889	1.4162332969	.2514 ns
Main Effects					
fert	100.30468	2	50.15234	1.3668704829	.2660 ns
cult	274.82222667	4	68.705556667	1.872526734	.1332 ns
Interaction					
fert x cult	204.61705333	8	25.577131667	0.6970886366	.6920 ns
Error	1541.0372133	42	36.691362222		
Total	2276.67176	59			

Table B4 (a) Two-way ANOVA randomized complete blocks-height of sweet corn plants 15 days after planting in warm field soils.

Source	SS	df	MS	F	P
Blocks	4.478565	3	1.492855	0.3290027173	.8044 ns
Main Effects					
fert	25.860223333	2	12.930111667	2.8496015178	.0691 ns
cult	97.665256667	4	24.416314167	5.3809872415	.0014 **
Interaction					
fert x cult	73.901193333	8	9.2376491667	2.0358384958	.0652 ns
Error	190.57566	42	4.5375157143		
Total	392.48089833	59			

Table B4 (b) Two-way ANOVA randomized complete blocks-height of sweet corn plants 32 days after planting in warm field soils.

Source	SS	df	MS	F	P
Blocks	92.31938	3	30.773126667	0.8178172733	.4913 ns
Main Effects					
fert	3.4342533333	2	1.7171266667	0.0456338371	.9554 ns
cult	345.71510667	4	86.428776667	2.2969049336	.0749 ns
Interaction					
fert x cult	466.38401333	8	58.298001667	1.5493099962	.1697 ns
Error	1580.39132	42	37.628364762		
Total	2488.2440733	59			

Table B4 (c) Two-way ANOVA randomized complete blocks-height of sweet corn plants 48 days after planting in warm field soils.

Source	SS	df	MS	F	P
Blocks	700.468	3	233.48933333	0.3991768286	.7543 ns
Main Effects					
fert	20.162333333	2	10.081166667	0.0172349121	.9829 ns
cult	16401.270667	4	4100.3176667	7.0099639202	.0002 ***
Interaction					
fert x cult	10748.299333	8	1343.5374167	2.2969315019	.0386 *
Error	24566.937	42	584.92707143		
Total	52437.137333	59			

Table B6 (a) Two-way ANOVA randomized complete blocks- fresh weight of sweet corn shoots at 15 days after planting in cold field soils.

Source	SS	df	MS	F	P
Blocks	0.0015306885	3	5.102295E-04	0.7194802371	.5460 ns
Main Effects					
fert	0.0030629623	2	0.0015314912	2.1595725604	.1280 ns
cult	0.0676111877	4	0.0169027969	23.834820083	.0000 ***
Interaction					
fert x cult	0.0027129143	8	3.391143E-04	0.4781887973	.8646 ns
Error	0.029784889	42	7.09164E-04		
Total	0.1047026618	59			

Table B6 (b) Two-way ANOVA randomized complete blocks- fresh weight of sweet corn shoots at 32 days after planting in cold field soils.

Source	SS	df	MS	F	P
Blocks	0.5201133333	3	0.1733711111	0.5240385065	.6681 ns
Main Effects					
fert	0.2000133333	2	0.1000066667	0.3022841805	.7407 ns
cult	6.2095066667	4	1.5523766667	4.6922762664	.0032 **
Interaction					
fert x cult	1.0659033333	8	0.1332379167	0.4027302958	.9127 ns
Error	13.895136667	42	0.3308365873		
Total	21.890673333	59			

Table B6 (c) Two-way ANOVA randomized complete blocks- fresh weight of sweet corn shoots at 48 days after planting in cold field soils.

Source	SS	df	MS	F	P
Blocks	122.15045833	3	40.716819444	0.1937233357	.9001 ns
Main Effects					
fert	429.85243	2	214.926215	1.0225804441	.3684 ns
cult	3888.4686767	4	972.11716917	4.6251594135	.0035 **
Interaction					
fert x cult	1090.4103533	8	136.30129417	0.6484971501	.7326 ns
Error	8827.5705667	42	210.18025159		
Total	14358.452485	59			

Table B7 (a) Two-way ANOVA randomized complete blocks- fresh weight of sweet corn shoots at 15 days after planting in warm field soils.

Source	SS	df	MS	F	P	
Blocks	1.288	3	0.4293333333	1.1723440705	.3317	ns
Main Effects						
fert	0.14475	2	0.072375	0.1976282658	.8214	ns
cult	7.2184166667	4	1.8046041667	4.9276793348	.0024	**
Interaction						
fert x cult	2.7786833333	8	0.3473354167	0.9484393235	.4882	ns
Error	15.38115	42	0.3662178571			
Total	26.811	59				

Table B7 (b) Two-way ANOVA randomized complete blocks- fresh weight of sweet corn shoots at 32 days after planting in warm field soils.

Source	SS	df	MS	F	P	
Blocks	195.12564	3	65.04188	0.9604398184	.4203	ns
Main Effects						
fert	52.213453333	2	26.106726667	0.3855045368	.6825	ns
cult	527.61799	4	131.9044975	1.9477655263	.1203	ns
Interaction						
fert x cult	390.06373	8	48.75796625	0.7193836821	.6728	ns
Error	2844.27916	42	67.720932381			
Total	4009.2999733	59				

Table B8 (a) Two-way ANOVA randomized complete blocks- dry weight of sweet corn shoots at 15 days after planting in cold field soils.

Source	SS	df	MS	F	P	
Blocks	0.0011195325	3	3.731775E-04	1.2449026438	.3056	ns
Main Effects						
fert	6.803053E-04	2	3.401527E-04	1.1347333481	.3312	ns
cult	0.0028146677	4	7.036669E-04	2.347399843	.0699	ns
Interaction						
fert x cult	0.0023319313	8	2.914914E-04	0.9724016996	.4704	ns
Error	0.012590105	42	2.997644E-04			
Total	0.0195365418	59				

Table B8 (b) Two-way ANOVA randomized complete blocks- dry weight of sweet corn shoots at 32 days after planting in cold field soils.

Source	SS	df	MS	F	P	
Blocks	7E-04	3	2.333333E-04	0.0545961003	.9830	ns
Main Effects						
fert	0.0080033333	2	0.0040016667	0.9363231198	.4001	ns
cult	0.1259266667	4	0.0314816667	7.366183844	.0001	***
Interaction						
fert x cult	0.0278633333	8	0.0034829167	0.8149442897	.5936	ns
Error	0.1795	42	0.0042738095			
Total	0.3419933333	59				

Table B8 (c) Two-way ANOVA randomized complete blocks- dry weight of sweet corn shoots at 49 days after planting in cold field soils.

Source	SS	df	MS	F	P	
Blocks	2.7171516667	3	0.9057172222	0.1759563979	.9121	ns
Main Effects						
fert	8.12752	2	4.06376	0.7894788283	.4607	ns
cult	92.976643333	4	23.244160833	4.5157127536	.0040	**
Interaction						
fert x cult	20.035746667	8	2.5044683333	0.4865505653	.8588	ns
Error	216.19062333	42	5.1473957937			
Total	340.047685	59				

Table B9 (a) Two-way ANOVA randomized complete blocks- dry weight of sweet corn shoots at 15 days after planting in warm field soils.

Source	SS	df	MS	F	P	
Blocks	0.0240998858	3	0.0080332953	0.5443531423	.6547	ns
Main Effects						
fert	0.042839509	2	0.0214197545	1.451448038	.2457	ns
cult	0.1523995883	4	0.0380998971	2.5817299105	.0509	ns
Interaction						
fert x cult	0.1097985177	8	0.0137248147	0.9300225817	.5022	ns
Error	0.6198152917	42	0.0147575069			
Total	0.9489527925	59				

Table B9 (b) Two-way ANOVA randomized complete blocks- dry weight of sweet corn shoots at 32 days after planting in warm field soils.

Source	SS	df	MS	F	P
Blocks	5.448805	3	1.8162683333	0.8441760711	.4775 ns
Main Effects					
fert	1.3844433333	2	0.6922216667	0.321734931	.7267 ns
cult	13.146056667	4	3.2865141667	1.5275257328	.2116 ns
Interaction					
fert x cult	12.743823333	8	1.5929779167	0.7403938143	.6556 ns
Error	90.36417	42	2.1515278571		
Total	123.08729833	59			

Table B10 (a) Two-way ANOVA randomized complete blocks- leaf area of seedlings at 32 days after planting in cold field soils.

Source	SS	df	MS	F	P
Blocks	705.39286458	3	235.13095486	0.9508230529	.4248 ns
Main Effects					
fert	17.832020833	2	8.9160104167	0.0360545818	.9646 ns
cult	4881.747235	4	1220.4368087	4.93520495	.0024 **
Interaction					
fert x cult	1990.33235	8	248.79154375	1.0060637711	.4461 ns
Error	10386.264904	42	247.29202153		
Total	17981.569375	59			

Table B10 (b) Two-way ANOVA randomized complete blocks- leaf area of seedlings at 49 days after planting in cold field soils.

Source	SS	df	MS	F	P
Blocks	280635.4381	3	93545.146033	1.3531872287	.2702 ns
Main Effects					
fert	71347.36453	2	35673.682265	0.5160414334	.6006 ns
cult	1668644.1642	4	417161.04105	6.0344872718	.0006 ***
Interaction					
fert x cult	129671.9185	8	16208.989813	0.2344728608	.9821 ns
Error	2903438.6742	42	69129.492243		
Total	5053737.5596	59			

Table B11 (a) Two-way ANOVA randomized complete blocks-leaf area of seedlings at 15 days after planting in warm field soils.

Source	SS	df	MS	F	P
Blocks	348.09853833	3	116.03284611	0.5978425569	.6200 ns
Main Effects					
fert	3.3477633333	2	1.6738816667	0.0086244346	.9914 ns
cult	2539.39556	4	634.84889	3.27096763	.0201 *
Interaction					
fert x cult	2080.68607	8	260.08575875	1.340054478	.2510 ns
Error	8151.6102867	42	194.08595921		
Total	13123.138218	59			

Table B11 (b) Two-way ANOVA randomized complete blocks-leaf area of seedlings at 32 days after planting in warm field soils.

Source	SS	df	MS	F	P
Blocks	58935.872925	3	19645.290975	1.2090796588	.3182 ns
Main Effects					
fert	23469.932523	2	11734.966262	0.7222346069	.4916 ns
cult	103542.00352	4	25885.500881	1.5931366257	.1939 ns
Interaction					
fert x cult	103993.88328	8	12999.23541	0.8000447097	.6059 ns
Error	682421.72045	42	16248.136201		
Total	972363.4127	59			

Table B12 (a) Two-way ANOVA randomized complete blocks - number of leaves on sweet corn seedlings at 32 days after planting in cold field soils.

Source	SS	df	MS	F	P
Blocks	0.1333333333	3	0.0444444444	0.0513290559	.9844 ns
Main Effects					
fert	1.4333333333	2	0.7166666667	0.8276810266	.4441 ns
cult	12.833333333	4	3.2083333333	3.7053162235	.0113 *
Interaction					
fert x cult	12.566666667	8	1.5708333333	1.8141613199	.1014 ns
Error	36.366666667	42	0.8658730159		
Total	63.333333333	59			

Table B12 (b) Two-way ANOVA randomized blocks - number of leaves on sweet corn seedlings at 49 days after planting in cold field soils.

Source	SS	df	MS	F	P
Blocks	4.6871666667	3	1.5623888889	0.533323761	.6620 ns
Main Effects					
fert	1.413	2	0.7065	0.2411648213	.7868 ns
cult	102.935	4	25.73375	8.7842536729	.0000 ***
Interaction					
fert x cult	3.937	8	0.492125	0.1679875976	.9940 ns
Error	123.04033333	42	2.929531746		
Total	236.0125	59			

Table B13 (a) Two-way ANOVA randomized blocks - number of leaves on sweet corn seedlings at 15 days after planting in warm field soils.

Source	SS	df	MS	F	P
Blocks	2.5698333333	3	0.8566111111	1.1014920194	.3592 ns
Main Effects					
fert	2.133	2	1.0665	1.3713822101	.2649 ns
cult	26.181	4	6.54525	8.4163520023	.0000 ***
Interaction					
fert x cult	23.102	8	2.88775	3.7132761154	.0023 **
Error	32.662666667	42	0.7776825397		
Total	86.6485	59			

Table B13 (b) Two-way ANOVA randomized blocks - number of leaves on sweet corn seedlings at 32 days after planting in warm field soils.

Source	SS	df	MS	F	P
Blocks	6.3685	3	2.1228333333	1.2913359597	.2899 ns
Main Effects					
fert	2.2173333333	2	1.1086666667	0.6744105208	.5149 ns
cult	59.689333333	4	14.922333333	9.0773709519	.0000 ***
Interaction					
fert x cult	19.442666667	8	2.4303333333	1.4783905915	.1941 ns
Error	69.044	42	1.6439047619		
Total	156.76183333	59			

Table B14 (a) Two-way ANOVA randomized blocks- chlorophyll a in sweet corn tissue at 15 days after planting in cold field soils

Source	SS	df	MS	F	P
Blocks	45.396608333	3	15.132202778	3.0405890074	.0484 *
Main Effects					
fert	3.4808388889	2	1.7404194444	0.3497111629	.7084 ns
cult	31.627622222	2	15.813811111	3.1775479708	.0597 ns
Interaction					
fert x cult	15.979611111	4	3.9949027778	0.802715748	.5355 ns
Error	119.44161667	24	4.9767340278		
Total	215.92629722	35			

Table B14 (b) Two-way ANOVA randomized blocks- chlorophyll a in sweet corn tissue at 32 days after planting in cold field soils.

Source	SS	df	MS	F	P
Blocks	6.5091466667	3	2.1697155556	0.9466423259	.4268 ns
Main Effects					
fert	7.42531	2	3.712655	1.6198235549	.2101 ns
cult	25.066906667	4	6.2667266667	2.7341596423	.0414 *
Interaction					
fert x cult	6.7913733333	8	0.8489216667	0.3703827347	.9304 ns
Error	96.264503333	42	2.2920119841		
Total	142.05724	59			

Table B14 (c) Two-way ANOVA randomized blocks- chlorophyll a in sweet corn tissue at 49 days after planting in cold field soils.

Source	SS	df	MS	F	P
Blocks	0.6354	3	0.2118	0.2582229537	.8550 ns
Main Effects					
fert	2.05009	2	1.025045	1.2497174108	.2970 ns
cult	11.66229	4	2.9155725	3.5546163492	.0138 *
Interaction					
fert x cult	6.28376	8	0.78547	0.95763165	.4813 ns
Error	34.4493	42	0.8202214286		
Total	55.08084	59			

Table B15 (a) Two-way ANOVA randomized blocks- chlorophyll a in sweet corn tissue at 15 days after planting in warm field soils.

Source	SS	df	MS	F	P
Blocks	85.365746667	3	28.455248889	1.1298502972	.3479 ns
Main Effects					
fert	61.09093	2	30.545465	1.2128448724	.3076 ns
cult	67.54071	4	16.8851775	0.6704465279	.6161 ns
Interaction					
fert x cult	235.67732	8	29.459665	1.1697318616	.3397 ns
Error	1057.7688533	42	25.184972698		
Total	1507.44356	59			

Table B15 (b) Two-way ANOVA randomized blocks- chlorophyll a in sweet corn tissue at 32 days after planting in warm field soils.

Source	SS	df	MS	F	P
Blocks	21.717493333	3	7.2391644444	3.2760421429	.0302 *
Main Effects					
fert	2.8049233333	2	1.4024616667	0.6346759435	.5351 ns
cult	7.15561	4	1.7889025	0.8095575152	.5262 ns
Interaction					
fert x cult	26.99466	8	3.3743325	1.5270347233	.1770 ns
Error	92.808606667	42	2.2097287302		
Total	151.48129333	59			

Table 16 (a) Two-way ANOVA randomized complete blocks- chlorophyll b in sweet corn tissue at 15 days after planting in cold field soils.

Source	SS	df	MS	F	P
Blocks	23.976363889	3	7.9921212963	1.2837600981	.3026 ns
Main Effects					
fert	1.3649388889	2	0.6824694444	0.1096238418	.8966 ns
cult	42.582005556	2	21.291002778	3.4199355591	.0493 *
Interaction					
fert x cult	3.7928277778	4	0.9482069444	0.1523087795	.9601 ns
Error	149.41336111	24	6.225556713		
Total	221.12949722	35			

Table 16 (b) Two-way ANOVA randomized complete blocks-chlorophyll b in sweet corn tissue at 32 days after planting in cold field soils.

Source	SS	df	MS	F	P
Blocks	27.676173333	3	9.2253911111	3.5987022249	.0211 *
Main Effects					
fert	6.3450833333	2	3.1725416667	1.2375662578	.3005 ns
cult	22.55876	4	5.63969	2.1999679695	.0854 ns
Interaction					
fert x cult	11.3001	8	1.4125125	0.5510023169	.8111 ns
Error	107.66837667	42	2.5635327778		
Total	175.54849333	59			

Table 16 (c) Two-way ANOVA randomized complete blocks-chlorophyll b in sweet corn tissue at 49 days after planting in cold field soils.

Source	SS	df	MS	F	P
Blocks	13.467845	3	4.4892816667	2.0575118456	.1204 ns
Main Effects					
fert	3.80784	2	1.90392	0.8725979441	.4253 ns
cult	44.133843333	4	11.033460833	5.0568171141	.0020 **
Interaction					
fert x cult	22.070626667	8	2.7588283333	1.2644165364	.2877 ns
Error	91.63973	42	2.1818983333		
Total	175.119885	59			

Table 17 (a) Two-way ANOVA randomized complete blocks-chlorophyll b in sweet corn tissue at 15 days after planting in warm field soils.

Source	SS	df	MS	F	P
Blocks	57.17566	3	19.058553333	1.3661614263	.2662 ns
Main Effects					
fert	94.481963333	2	47.240981667	3.3863434315	.0433 *
cult	129.90629333	4	32.476573333	2.3279963054	.0718 ns
Interaction					
fert x cult	239.59538667	8	29.949423333	2.1468443162	.0522 ns
Error	585.91849	42	13.950440238		
Total	1107.0777933	59			

Table 17 (b) Two-way ANOVA randomized complete blocks-chlorophyll b in sweet corn tissue at 32 days after planting in warm field soils.

Source	SS	df	MS	F	P
Blocks	10.908826667	3	3.6362755556	1.7142063963	.1787 ns
Main Effects					
fert	5.6230633333	2	2.8115316667	1.3254071351	.2766 ns
cult	13.479343333	4	3.3698358333	1.588601868	.1951 ns
Interaction					
fert x cult	28.451786667	8	3.5564733333	1.6765861781	.1328 ns
Error	89.092873333	42	2.1212588889		
Total	147.55589333	59			

Table B18 (a) Two-way ANOVA randomized complete blocks-total chlorophyll in sweet corn tissues at 15 days after planting in cold field soils.

Source	SS	df	MS	F	P
Blocks	125.64371111	3	41.881237037	2.193512324	.1150 ns
Main Effects					
fert	0.6558388889	2	0.3279194444	0.0171746442	.9830 ns
cult	138.79593889	2	69.397969444	3.6346897085	.0418 *
Interaction					
fert x cult	29.666194444	4	7.4165486111	0.3884386406	.8148 ns
Error	458.23753889	24	19.093230787		
Total	752.99922222	35			

Table B18 (b) Two-way ANOVA randomized complete blocks-total chlorophyll in sweet corn tissues at 32 days after planting in cold field soils.

Source	SS	df	MS	F	P
Blocks	53.238993333	3	17.746331111	2.2839326557	.0928 ns
Main Effects					
fert	27.223163333	2	13.611581667	1.7517950989	.1859 ns
cult	78.43069	4	19.6076725	2.5234851781	.0550 ns
Interaction					
fert x cult	25.14482	8	3.1431025	0.4045137215	.9116 ns
Error	326.34320667	42	7.7700763492		
Total	510.38087333	59			

Table B18 (c) Two-way ANOVA randomized complete blocks-total chlorophyll in sweet corn tissues at 49 days after planting in cold field soils.

Source	SS	df	MS	F	P
Blocks	16.999058333	3	5.6663527778	1.754957384	.1705 ns
Main Effects					
fert	4.5593633333	2	2.2796816667	0.7060527876	.4994 ns
cult	73.711126667	4	18.427781667	5.7073699388	.0009 ***
Interaction					
fert x cult	15.660353333	8	1.9575441667	0.606281805	.7673 ns
Error	135.60831667	42	3.2287694444		
Total	246.53821833	59			

Table B19 (a) Two-way ANOVA randomized complete blocks-total chlorophyll in sweet corn tissues at 15 days after planting in warm field soils.

Source	SS	df	MS	F	P
Blocks	15.759966667	3	5.2533222222	0.6192947414	.6064 ns
Main Effects					
fert	32.397343333	2	16.198671667	1.9096015354	.1608 ns
cult	53.07741	4	13.2693525	1.5642749251	.2015 ns
Interaction					
fert x cult	346.98719	8	43.37339875	5.1131296783	.0002 ***
Error	356.27548333	42	8.4827496032		
Total	804.49739333	59			

Table B19 (b) Two-way ANOVA randomized complete blocks-total chlorophyll in sweet corn tissues at 32 days after planting in warm field soils.

Source	SS	df	MS	F	P
Blocks	53.120333333	3	17.706777778	2.9251628123	.0448 *
Main Effects					
fert	11.532643333	2	5.7663216667	0.9525973565	.3939 ns
cult	35.418823333	4	8.8547058333	1.4627989656	.2306 ns
Interaction					
fert x cult	99.957756667	8	12.494719583	2.0641298792	.0616 ns
Error	254.23701667	42	6.0532623016		
Total	454.26657333	59			

Table B20 (a) Two-way ANOVA randomized complete blocks-potassium content in sweet corn tissues at 49 days after planting in cold field soils.

Source	SS	df	MS	F	P
Blocks	7.5420183333	3	2.5140061111	0.2130082752	.8868 ns
Main Effects					
fert	9.7079433333	2	4.8539716667	0.4112703338	.6654 ns
cult	18.577343333	4	4.6443358333	0.3935081783	.8121 ns
Interaction					
fert x cult	59.643856667	8	7.4554820833	0.6316927282	.7463 ns
Error	495.70025667	42	11.802387063		
Total	591.17141833	59			

Table B20 (b) Two-way ANOVA randomized complete blocks-potassium content in sweet corn tissues at 32 days after planting in warm field soils.

Source	SS	df	MS	F	P
Blocks	5.35	3	1.7833333333	0.4637950385	.7091 ns
Main Effects					
fert	0.11875	2	0.059375	0.0154417741	.9847 ns
cult	22.910416667	4	5.7276041667	1.4895893804	.2226 ns
Interaction					
fert x cult	32.402083333	8	4.0502604167	1.0533592631	.4132 ns
Error	161.49375	42	3.8450892857		
Total	222.275	59			

Table B21 (a) Two-way ANOVA completely randomized- number of sweet corn seedlings emerged in growth chamber for 15 days at $15^{0}C$ (First Run).

Source	SS	df	MS	F	P
Main Effects					
fert	0.8444444444	2	0.4222222222	0.2753623188	.7612 ns
cult	45.466666667	4	11.366666667	7.4130434783	.0003 ***
Interaction					
fert x cult	2.9333333333	8	0.3666666667	0.2391304348	.9799 ns
Error	46	30	1.5333333333		
Total	95.244444444	44			

Table B21 (b) Two-way ANOVA completely randomized- number of sweet corn seedlings emerged in growth chamber for 15 days at 15^{0}C (Second Run).

Source	SS	df	MS	F	P	
Main Effects						
fert	0.1333333333	2	0.0666666667	0.0769230769	.9261	ns
cult	128.31111111	4	32.077777778	37.012820513	.0000	***
Interaction						
fert x cult	14.755555556	8	1.8444444444	2.1282051282	.0642	ns
Error	26	30	0.8666666667			
Total	169.2	44				

Table B22 (a) Two-way ANOVA completely randomized-number of sweet corn seedlings emerged in growth chambers for 15 days at 25^{0}C (First Run)

Source	SS	df	MS	F	P	
Main Effects						
fert	384.4	2	192.2	1.051933836	.3618	ns
cult	968.97777778	4	242.24444444	1.3258331306	.2831	ns
Interaction						
fert x cult	1510.4888889	8	188.81111111	1.0333860375	.4336	ns
Error	5481.3333333	30	182.71111111			
Total	8345.2	44				

Table B22 (b) Two-way ANOVA completely randomized-number of sweet corn seedlings emerged in growth chambers for 15 days at 25^{0}C (Second Run).

Source	SS	df	MS	F	P	
Main Effects						
fert	0.5777777778	2	0.2888888889	0.2826086957	.7558	ns
cult	70.533333333	4	17.633333333	17.25	.0000	***
Interaction						
fert x cult	8.5333333333	8	1.0666666667	1.0434782609	.4269	ns
Error	30.666666667	30	1.0222222222			
Total	110.31111111	44				

Table B23 (a) Two-way ANOVA completely randomized-number of leaves on sweet corn seedlings in growth chambers for 15 days at 15^{0}C (First Run).

Source	SS	df	MS	F	P
Main Effects					
fert	0.0253333333	2	0.0126666667	0.0874233129	.9165 ns
cult	5.8555555556	4	1.4638888889	10.103527607	.0000 ***
Interaction					
fert x cult	0.5524444444	8	0.0690555556	0.4766104294	.8629 ns
Error	4.3466666667	30	0.1448888889		
Total	10.78	44			

Table B23 (b) Two-way ANOVA completely randomized-number of leaves on sweet corn seedlings in growth chambers for 15 days at 15^{0}C (Second Run)

Source	SS	df	MS	F	P
Main Effects					
fert	0.4697777778	2	0.2348888889	1.6286594761	.2131 ns
cult	3.8542222222	4	0.9635555556	6.6810477658	.0006 ***
Interaction					
fert x cult	0.8857777778	8	0.1107222222	0.7677195686	.6334 ns
Error	4.3266666667	30	0.1442222222		
Total	9.5364444444	44			

Table B24 (a) Two-way ANOVA completely randomized-number of leaves on sweet corn seedlings in growth chambers for 15 days at 25^{0}C (First Run)

Source	SS	df	MS	F	P
Main Effects					
fert	1.5897777778	2	0.7948888889	6.7874762808	.0037 **
cult	3.7377777778	4	0.9344444444	7.9791271347	.0002 ***
Interaction					
fert x cult	0.5368888889	8	0.0671111111	0.5730550285	.7915 ns
Error	3.5133333333	30	0.1171111111		
Total	9.3777777778	44			

Table B24 (b) Two-way ANOVA completely randomized-number of leaves on sweet corn seedlings in growth chambers for 15 days at 25^{0}C (Second Run).

Source	SS	df	MS	F	P
Main Effects					
fert	0.0404444444	2	0.0202222222	0.2954545455	.7463 ns
cult	0.2955555556	4	0.0738888889	1.0795454545	.3841 ns
Interaction					
fert x cult	0.3484444444	8	0.0435555556	0.6363636364	.7409 ns
Error	2.0533333333	30	0.0684444444		
Total	2.7377777778	44			

Table B25 (a) Two-way ANOVA completely randomized- leaf area of sweet corn seedlings in growth chambers for 15 days at 15^{0}C (First Run).

Source	SS	df	MS	F	P
Main Effects					
fert	9.9318977778	2	4.9659488889	1.1266866189	.3374 ns
cult	68.412622222	4	17.103155556	3.8804057263	.0117 *
Interaction					
fert x cult	46.820257778	8	5.8525322222	1.327836812	.2680 ns
Error	132.22706667	30	4.4075688889		
Total	257.39184444	44			

Table B25 (b) Two-way ANOVA completely randomized- leaf area of sweet corn seedlings in growth chambers for 15 days at 15^{0}C (Second Run).

Source	SS	df	MS	F	P
Main Effects					
fert	11.584457778	2	5.7922288889	2.5399239729	.0957 ns
cult	29.069142222	4	7.2672855556	3.1867443698	.0270 *
Interaction					
fert x cult	35.531497778	8	4.4414372222	1.9475944565	.0891 ns
Error	68.4142	30	2.2804733333		
Total	144.59929778	44			

Table B26 (a) Two-way ANOVA completely randomized- leaf area of sweet corn seedlings in growth chambers for 15 days at 25^{0}C (First Run).

Source	SS	df	MS	F	P	
Main Effects						
fert	121.32536444	2	60.662682222	4.5729944762	.0185	*
cult	153.62001333	4	38.405003333	2.8951220366	.0387	*
Interaction						
fert x cult	163.61768	8	20.45221	1.5417690074	.1848	ns
Error	397.96253333	30	13.265417778			
Total	836.52559111	44				

Table B26 (b) Two-way ANOVA completely randomized- leaf area of sweet corn seedlings in growth chambers for 15 days at 25^{0}C (Second Run).

Source	SS	df	MS	F	P	
Main Effects						
fert	210.70423111	2	105.35211556	5.0476639179	.0129	*
cult	456.95505333	4	114.23876333	5.4734438	.0020	**
Interaction						
fert x cult	216.33001333	8	27.041251667	1.2956090119	.2831	ns
Error	626.1438	30	20.87146			
Total	1510.1330978	44				

Table B27 (a) Two-way ANOVA completely randomized- height of sweet corn seedlings in growth chambers for 15 days at 15^{0}C (First Run).

Source	SS	df	MS	F	P	
Main Effects						
fert	0.9084444444	2	0.4542222222	0.1568256764	.8555	ns
cult	51.972644444	4	12.993161111	4.4860448933	.0058	**
Interaction						
fert x cult	5.8546222222	8	0.7318277778	0.2526723279	.9762	ns
Error	86.890533333	30	2.8963511111			
Total	145.62624444	44				

Table B27 (b) Two-way ANOVA completely randomized- height of sweet corn seedlings in growth chambers for 15 days at 15^{0}C (Second Run).

Source	SS	df	MS	F	P
Main Effects					
fert	0.8057777778	2	0.4028888889	0.4285038998	.6554 ns
cult	35.500888889	4	8.8752222222	9.4394942094	.0000 ***
Interaction					
fert x cult	6.1764444444	8	0.7720555556	0.8211415741	.5904 ns
Error	28.206666667	30	0.9402222222		
Total	70.689777778	44			

Table B28 (a) Two-way ANOVA completely randomized- height of sweet corn seedlings in growth chambers for 15 days at 25^{0}C (First Run).

Source	SS	df	MS	F	P
Main Effects					
fert	20.635444444	2	10.317722222	0.5827666818	.5645 ns
cult	517.60911111	4	129.40227778	7.3089131901	.0003 ***
Interaction					
fert x cult	91.976222222	8	11.497027778	0.6493763434	.7304 ns
Error	531.14166667	30	17.704722222		
Total	1161.3624444	44			

Table B28 (b) Two-way ANOVA completely randomized- height of sweet corn seedlings in growth chambers for 15 days at 25^{0}C (Second Run).

Source	SS	df	MS	F	P
Main Effects					
fert	13.901777778	2	6.9508888889	0.600099764	.5552 ns
cult	300.68088889	4	75.170222222	6.4897645953	.0007 ***
Interaction					
fert x cult	69.433777778	8	8.6792222222	0.7493141224	.6484 ns
Error	347.48666667	30	11.582888889		
Total	731.50311111	44			

Table B29 (a) Two-way ANOVA completely randomized-fresh weight of sweet corn seedlings in growth chambers for 15 days at 15^{0}C (First Run).

Source	SS	df	MS	F	P
Main Effects					
fert	0.0084933333	2	0.0042466667	0.9174267883	.4105 ns
cult	0.14652	4	0.03663	7.9133461354	.0002 ***
Interaction					
fert x cult	0.01164	8	0.001455	0.3143302928	.9544 ns
Error	0.1388666667	30	0.0046288889		
Total	0.30552	44			

Table B29 (b) Two-way ANOVA completely randomized-fresh weight of sweet corn seedlings in growth chambers for 15 days at 15^{0}C (Second Run).

Source	SS	df	MS	F	P
Main Effects					
fert	0.0011911111	2	5.955556E-04	0.2938596491	.7475 ns
cult	0.0378533333	4	0.0094633333	4.6694078947	.0047 **
Interaction					
fert x cult	0.0307866667	8	0.0038483333	1.8988486842	.0974 ns
Error	0.0608	30	0.0020266667		
Total	0.1306311111	44			

Table B30 (a) Two-way ANOVA completely randomized-fresh weight of sweet corn seedlings in growth chambers for 15 days at 25^{0}C (First Run).

Source	SS	df	MS	F	P
Main Effects					
fert	0.2914311111	2	0.1457155556	5.4716288385	.0094 **
cult	0.3462977778	4	0.0865744444	3.2508761682	.0250 *
Interaction					
fert x cult	0.3663688889	8	0.0457961111	1.7196470294	.1346 ns
Error	0.7989333333	30	0.0266311111		
Total	1.8030311111	44			

Table B30 (b) Two-way ANOVA completely randomized-fresh weight of sweet corn seedlings in growth chambers for 15 days at 25^{0}C (Second Run).

Source	SS	df	MS	F	P
Main Effects					
fert	0.1134933333	2	0.0567466667	3.120615911	.0587 ns
cult	0.2329466667	4	0.0582366667	3.2025540755	.0265 *
Interaction					
fert x cult	0.2305066667	8	0.0288133333	1.5845044605	.1713 ns
Error	0.5455333333	30	0.0181844444		
Total	1.12248	44			

Table B31 (a) Two-way ANOVA completely randomized- dry weight of sweet corn seedlings in growth chambers for 15 days at 15^{0}C (First Run).

Source	SS	df	MS	F	P
Main Effects					
fert	1.499244E-05	2	7.496222E-06	0.2125636437	.8097 ns
cult	0.0013996258	4	3.499064E-04	9.9219829107	.0000 ***
Interaction					
fert x cult	1.246342E-04	8	1.557928E-05	0.4417675934	.8861 ns
Error	0.0010579733	30	3.526578E-05		
Total	0.0025972258	44			

Table B31 (b) Two-way ANOVA completely randomized- dry weight of sweet corn seedlings in growth chambers for 15 days at 15^{0}C (Second Run).

Source	SS	df	MS	F	P
Main Effects					
fert	3.057778E-05	2	1.528889E-05	0.8161328588	.4517 ns
cult	5.928E-04	4	1.482E-04	7.9110320285	.0002 ***
Interaction					
fert x cult	1.918667E-04	8	2.398333E-05	1.2802491103	.2906 ns
Error	5.62E-04	30	1.873333E-05		
Total	0.0013772444	44			

Table B32 (a) Two-way ANOVA completely randomized- dry weight of sweet corn seedlings in growth chambers for 15 days at 25^{0}C (First Run).

Source	SS	df	MS	F	P
Main Effects					
fert	0.0018704031	2	9.352016E-04	2.965197528	.0668 ns
cult	0.0060195169	4	0.0015048792	4.7714464579	.0042 **
Interaction					
fert x cult	0.0028822458	8	3.602807E-04	1.1423243477	.3649 ns
Error	0.00946178	30	3.153927E-04		
Total	0.0202339458	44			

Table B32 (b) Two-way ANOVA completely randomized- dry weight of sweet corn seedlings in growth chambers for 15 days at 25^{0}C (Second Run).

Source	SS	df	MS	F	P
Main Effects					
fert	0.0016647111	2	8.323556E-04	2.4676197378	.1018 ns
cult	0.0048220889	4	0.0012055222	3.5739179129	.0169 *
Interaction					
fert x cult	0.0025735111	8	3.216889E-04	0.9536860136	.4892 ns
Error	0.0101193333	30	3.373111E-04		
Total	0.0191796444	44			

Table B33 (a) Two-way ANOVA completely randomized- chlorophyll a in sweet corn tissues in growth chambers for 15 days at 15^{0}C (First Run).

Source	SS	df	MS	F	P
Main Effects					
fert	44.425524444	2	22.212762222	4.5500033002	.0188 *
cult	15.466008889	4	3.8665022222	0.7920040603	.5397 ns
Interaction					
fert x cult	3.5156977778	8	0.4394622222	0.090018276	.9993 ns
Error	146.45766667	30	4.8819222222		
Total	209.86489778	44			

Table B33 (b) Two-way ANOVA completely randomized-chlorophyll a in sweet corn tissues in growth chambers for 15 days at 15^0C (Second Run).

Source	SS	df	MS	F	P
Main Effects					
fert	2.7886933333	2	1.3943466667	0.2154020336	.8075 ns
cult	64.452208889	4	16.113052222	2.4891831416	.0643 ns
Interaction					
fert x cult	29.221751111	8	3.6527188889	0.5642808174	.7983 ns
Error	194.19686667	30	6.4732288889		
Total	290.65952	44			

Table B34 (a) Two-way ANOVA completely randomized-chlorophyll a in sweet corn tissues in growth chambers for 15 days at 25^0C (First Run).

Source	SS	df	MS	F	P
Main Effects					
fert	16.449951111	2	8.2249755556	1.6546427816	.2081 ns
cult	28.302342222	4	7.0755855556	1.4234165787	.2503 ns
Interaction					
fert x cult	27.662004444	8	3.4577505556	0.6956059576	.6925 ns
Error	149.1254	30	4.9708466667		
Total	221.53969778	44			

Table B34 (b) Two-way ANOVA completely randomized-chlorophyll a in sweet corn tissues in growth chambers for 15 days at 25^0C (Second Run).

Source	SS	df	MS	F	P
Main Effects					
fert	10.318297778	2	5.1591488889	1.1452005615	.3317 ns
cult	33.4888	4	8.3722	1.8584166396	.1438 ns
Interaction					
fert x cult	25.468413333	8	3.1835516667	0.7066679475	.6834 ns
Error	135.15053333	30	4.5050177778		
Total	204.42604444	44			

Table B35 (a) Two-way ANOVA completely randomized-chlorophyll b in sweet corn tissues in growth chambers for 15 days at 15^{0}C (First Run).

Source	SS	df	MS	F	P
Main Effects					
fert	13.52964	2	6.76482	1.0250610827	.3710 ns
cult	42.086213333	4	10.521553333	1.5943121697	.2015 ns
Interaction					
fert x cult	32.864493333	8	4.1080616667	0.6224872413	.7522 ns
Error	197.98293333	30	6.5994311111		
Total	286.46328	44			

Table B35 (b) Two-way ANOVA completely randomized-chlorophyll b in sweet corn tissues in growth chambers for 15 days at 15^{0}C (Second Run).

Source	SS	df	MS	F	P
Main Effects					
fert	0.0033644444	2	0.0016822222	7.132735E-04	.9993 ns
cult	69.1396	4	17.2849	7.3289132991	.0003 ***
Interaction					
fert x cult	15.749213333	8	1.9686516667	0.8347214841	.5796 ns
Error	70.7536	30	2.3584533333		
Total	155.64577778	44			

Table B36 (a) Two-way ANOVA completely randomized-chlorophyll b in sweet corn tissues in growth chambers for 15 days at 25^{0}C (First Run).

Source	SS	df	MS	F	P
Main Effects					
fert	17.854093333	2	8.9270466667	1.6418684379	.2105 ns
cult	42.95508	4	10.73877	1.975081814	.1238 ns
Interaction					
fert x cult	21.879706667	8	2.7349633333	0.5030162991	.8443 ns
Error	163.1138	30	5.4371266667		
Total	245.80268	44			

Table B36 (b) Two-way ANOVA completely randomized-chlorophyll b in sweet corn tissues in growth chambers for 15 days at 25^{0}C (Second Run).

Source	SS	df	MS	F	P
Main Effects					
fert	3.3779511111	2	1.6889755556	0.6035835138	.5534 ns
cult	40.724177778	4	10.181044444	3.6383656115	.0156 *
Interaction					
fert x cult	19.410448889	8	2.4263061111	0.8670808546	.5542 ns
Error	83.9474	30	2.7982466667		
Total	147.45997778	44			

Table B37 (a) Two-way ANOVA completely randomized-total chlorophyll in sweet corn tissues in growth chambers for 15 days at 15^{0}C (First Run).

Source	SS	df	MS	F	P
Main Effects					
fert	2507.3138978	2	1253.6569489	1.330440731	.2795 ns
cult	4013.6970444	4	1003.4242611	1.0648818312	.3910 ns
Interaction					
fert x cult	6806.4335022	8	850.80418778	0.9029141078	.5268 ns
Error	28268.608733	30	942.28695778		
Total	41596.053178	44			

Table B37 (b) Two-way ANOVA completely randomized-total chlorophyll in sweet corn tissues in growth chambers for 15 days at 15^{0}C (Second Run).

Source	SS	df	MS	F	P
Main Effects					
fert	3.0177244444	2	1.5088622222	0.1292621324	.8792 ns
cult	264.84968	4	66.21242	5.6723261256	.0016 **
Interaction					
fert x cult	75.66772	8	9.458465	0.8102935692	.5990 ns
Error	350.1866	30	11.672886667		
Total	693.72172444	44			

Table B38 (a) Two-way ANOVA completely randomized-total chlorophyll in sweet corn tissues in growth chambers for 15 days at 25^{0}C (First Run).

Source	SS	df	MS	F	P
Main Effects					
fert	68.613684444	2	34.306842222	1.7404949705	.1927 ns
cult	140.64278667	4	35.160696667	1.7838137164	.1582 ns
Interaction					
fert x cult	95.737093333	8	11.967136667	0.6071308131	.7645 ns
Error	591.32906667	30	19.710968889		
Total	896.32263111	44			

Table B38 (b) Two-way ANOVA completely randomized-total chlorophyll in sweet corn tissues in growth chambers for 15 days at 25^{0}C (Second Run).

Source	SS	df	MS	F	P
Main Effects					
fert	25.360284444	2	12.680142222	1.001370771	.3793 ns
cult	143.52245333	4	35.880613333	2.8335484577	.0418 *
Interaction					
fert x cult	70.98976	8	8.87372	0.7007716225	.6882 ns
Error	379.88353333	30	12.662784444		
Total	619.75603111	44			

APPENDIX C
ENVIRONMENTAL DATA

Table C1. Soil nutrient data for cold and warm plantings before application of potash.

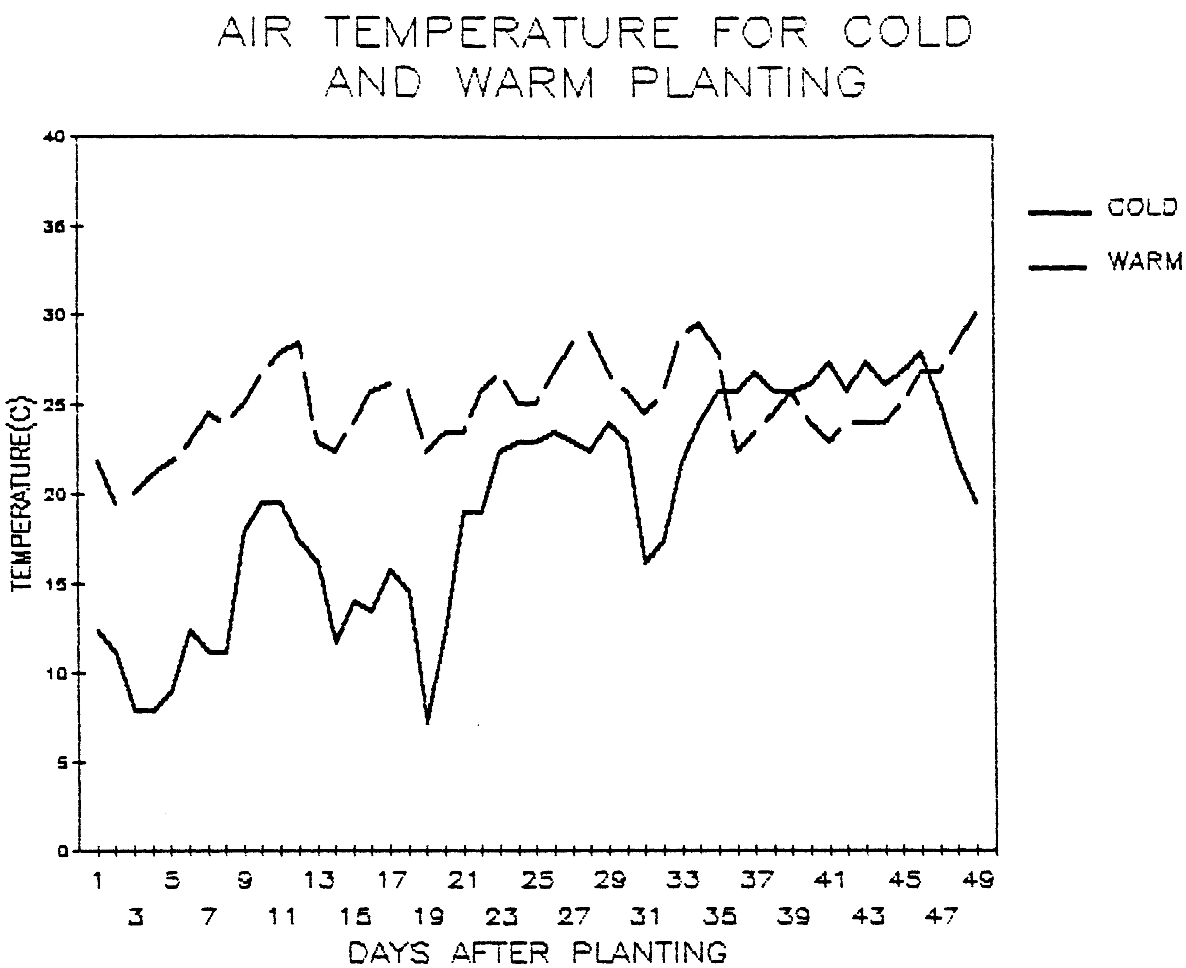
Depth (cm)	pH	P lbs/A[z]	K lbs/A	%OM content
		Cold		
7.5	6.1	79	326	3.2
15.0	6.0	58	235	3.2
		Warm		
7.5	6.1	77	316	2.7
15.0	6.2	79	291	2.5

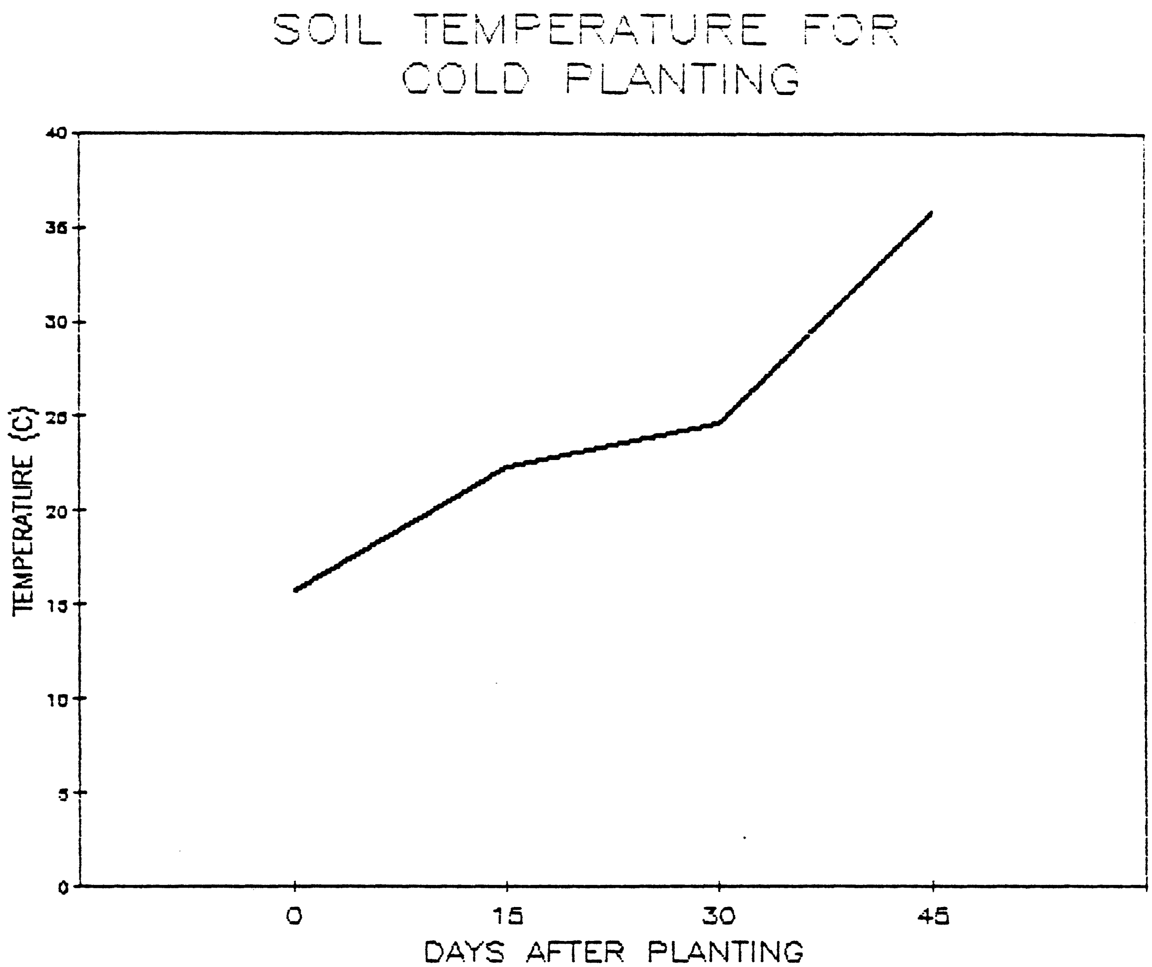
[z] 1lb/A = 1.12 kg/ha

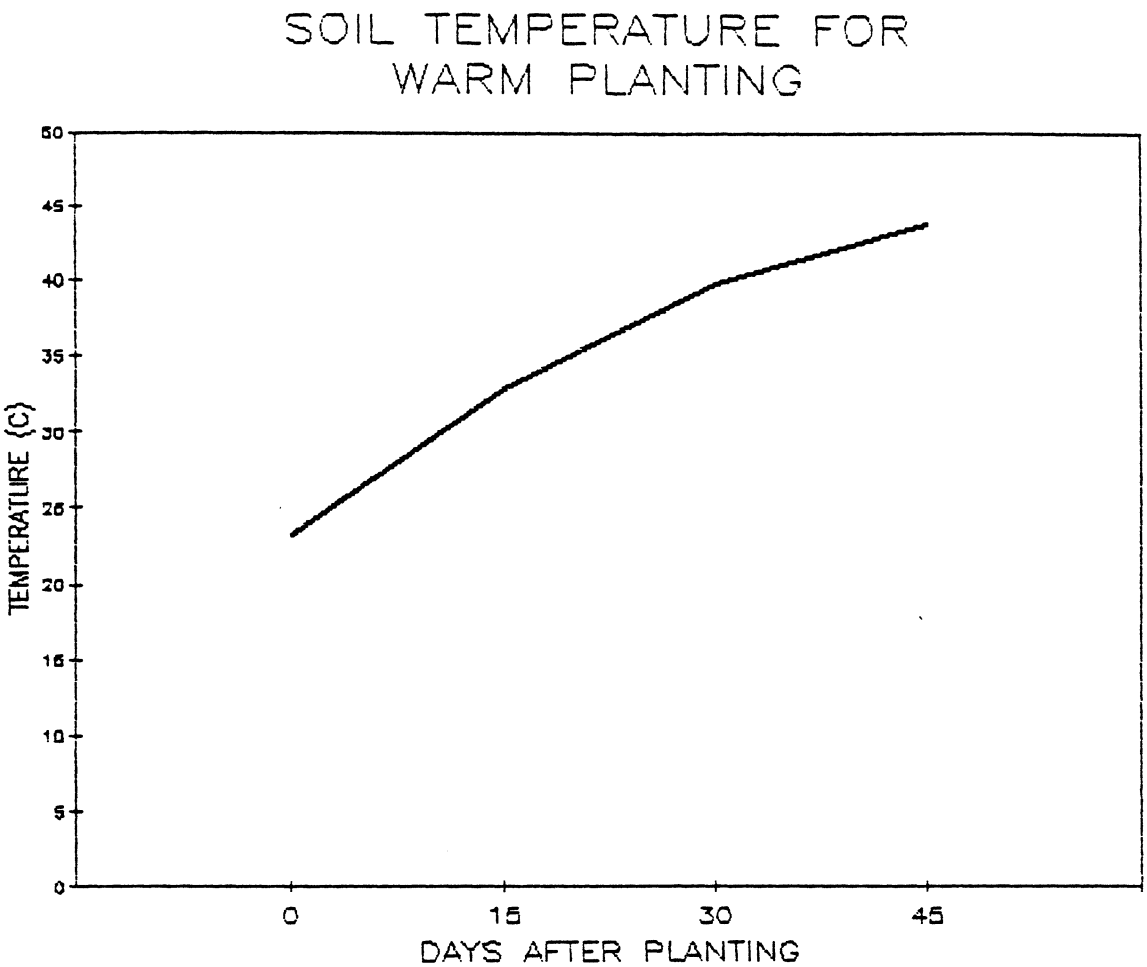
Table C2. Soil nutrient data for cold and warm planting after application of potash at 15.0 cm at end of study.

Fertilizer (kg/ha)	pH	P lbs/A[z]	K lbs/A	%OM content
		Cold		
0	6.4	84	311	3.2
45	5.8	79	277	3.5
90	5.7	69	311	3.5
		Warm		
0	6.3	81	263	2.5
45	6.2	60	301	2.7
90	6.3	55	281	2.5

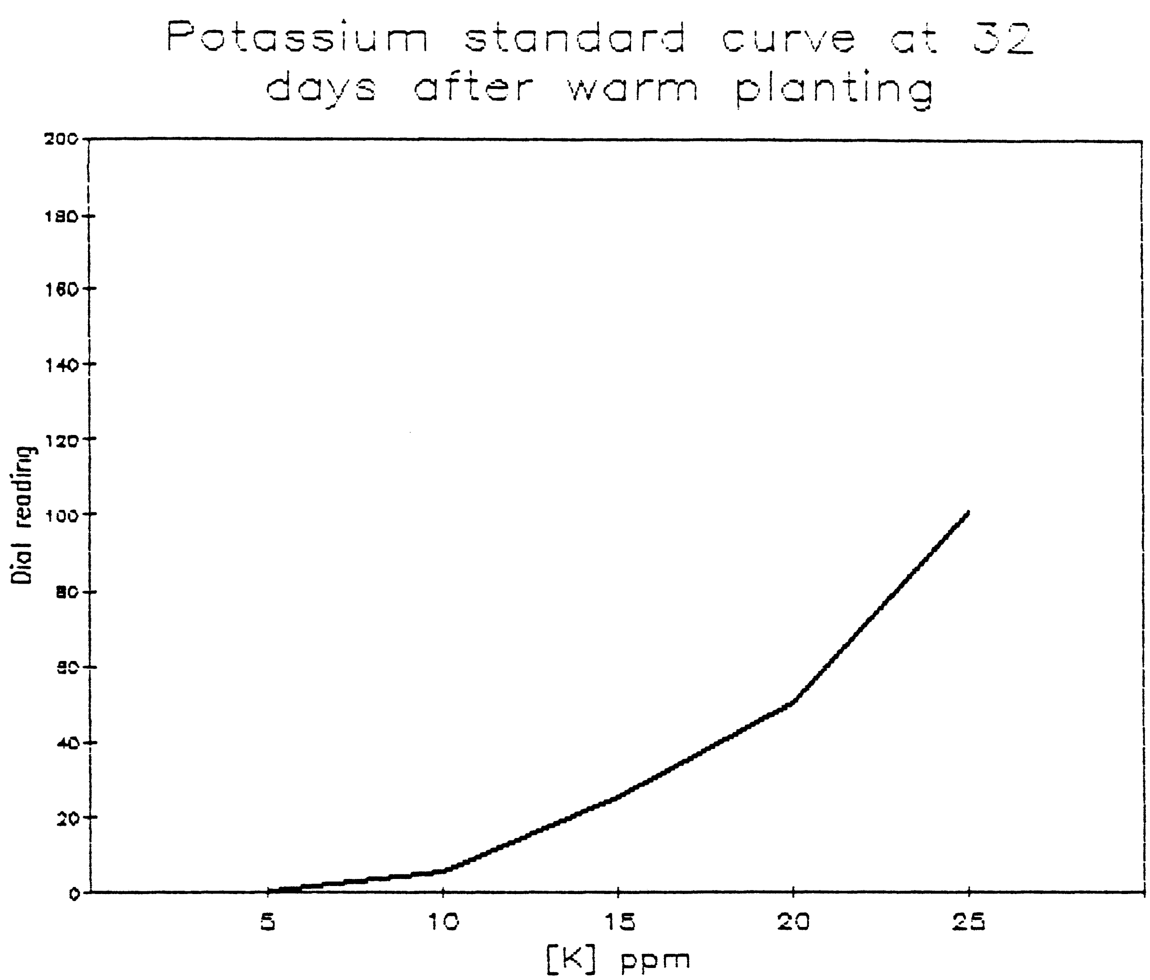
[z] 1lb/A = 1.12 kg/ha

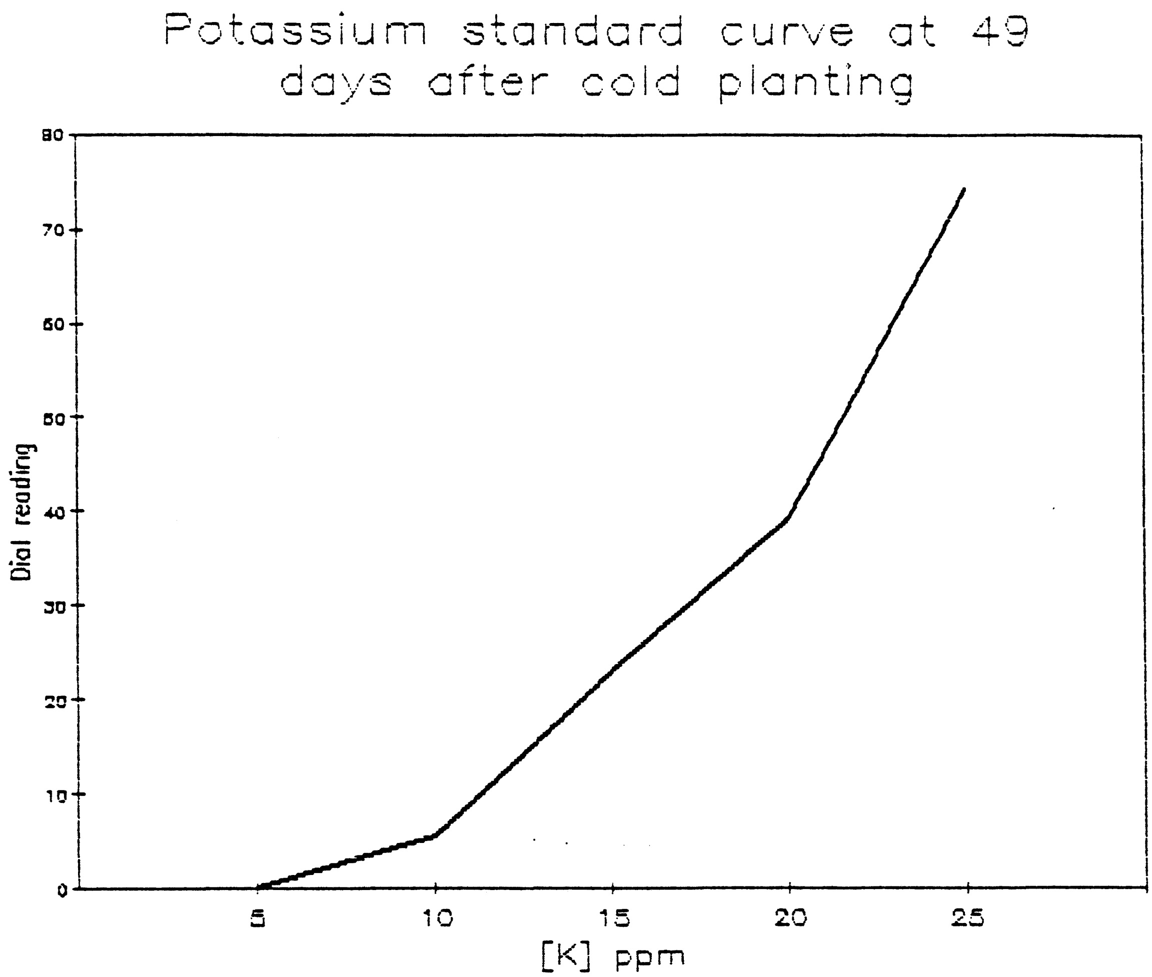

AIR TEMPERATURE FOR COLD
AND WARM PLANTING
COLD
WARM
TEMPERATURE(C)
40
35
30
25
20
15
10
5
0
1
3
5
7
9
11
13
15
17
19
21
23
25
27
29
31
33
35
37
39
41
43
45
47
49
DAYS AFTER PLANTING


SOIL TEMPERATURE FOR
COLD PLANTING
TEMPERATURE (C)
40
35
30
25
20
15
10
5
0
0
15
30
45
DAYS AFTER PLANTING


SOIL TEMPERATURE FOR
WARM PLANTING
TEMPERATURE (C)
50
45
40
35
30
25
20
15
10
5
0
0
15
30
45
DAYS AFTER PLANTING

APPENDIX D
POTASSIUM ANALYSIS STANDARD CURVES


Potassium standard curve at 32
days after warm planting
Dial reading
200
180
160
140
120
100
80
60
40
20
0
5
10
15
20
25
[K] ppm



Potassium standard curve at 49 days after cold planting
Dial reading
[K] ppm
0
10
20
30
40
50
60
70
80
5
10
15
20
25

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