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# CORN MANAGEMENT STUDIES IN MINNESOTA: 1973 to 1975

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1977

PLANTING DATE
STARTER
FERTILIZER
HYBRID MATURITY

# Corn Management Studies in Minnesota: 1973 to 1975

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Rapid advancements in corn production technology have increased grain yields over the past several years. Fertilizer applications have contributed much to these increases. During the 1960's, fertilizer was relatively inexpensive and farmer use increased greatly. Consequently, soil fertility levels were increased to very high levels on many farms.

The objectives of this study were to evaluate the effects of starter fertilizer and planting date on early plant growth, yield, and grain moisture content at harvest of corn grown on soils medium to high in phosphorus (P) and potassium (K). From 1973 to 1975, side-by-side comparisons of starter and no starter fertilizer were evaluated for three planting dates with nine hybrids for each date. Three locations (Lamberton, Morris, and Waseca) were included in the 3-year study.

Table 1 gives planting dates, soil test results, fertilizer applications, and selected weather data for each location. In 1974 all three locations received a killing frost on September 3; however, growing degree days were calculated through September 30. Only two planting dates were included at the Waseca location in 1975 because of wet field conditions in early May.

The same nine hybrids were grown at Waseca and Lamberton each year with three hybrids representing each of the following relative maturity (RM) groups: 110-115, 100-105, and 90-95. The nine hybrids for Morris included three hybrids from each of the following: 100-105, 90-95, and 80-85 RM.

Each plot consisted of four 30-inch rows with yield data collected from the two center rows. All plots were planted with a standard corn planter modified for research plots. Starter fertilizer was placed 2 inches to the side and 2 inches below the seed with standard planter mounted fertilizer attachments. Final harvest populations of 24,000 at Waseca and Lamberton and 22,000 at Morris were obtained by overplanting and thinning to the desired final population.

Plant samples to determine early growth and grain samples to determine drying rates were taken from the two outside rows in each plot. Samples for moisture determination consisted of center ear sections taken from five consecutive plants. Moisture sampling began when the black layer developed and continued weekly until the last week of October each year. Because of the early frost in 1974 and the drought in 1975, only the 1973 data are presented to show the effects of planting

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date and hybrid maturity on emergence, tasseling, silking, and drying rate of ears.

Yields were obtained by combine harvesting at Waseca and hand harvesting at Lamberton and Morris. Harvest moisture for Lamberton and Morris was determined from center sections of 10 randomly selected ears; however, shelled corn samples were used at Waseca. Yield data for each location were converted to 15.5 percent moisture equivalent.

Plant samples for plant nutrient concentration were taken at two plant stages: (1) the whole plant at approximately 12 inches tall, and (2) the leaf below and opposite the ear at tasseling (referred to as the "ear leaf"). Concentrations of nine nutrients in the plant (or leaf) were determined by use of the emission spectrograph.

## Results and Discussion

### PLANTING DATE

**Grain Yield:** Early planting (late April) produced the highest corn grain yields at all locations (Table 2). Little yield difference occurred between the early and mid-May planting dates at Morris while the yield differences between these two planting dates were 7 to 15 bu/a at the other two locations. The average yield difference between the mid-May and late planting dates was 8 to 16 bu/a at all three locations.

Generally, the yield of the three maturity groups declined equally as planting was delayed. Previous date of planting studies showed the yield reduction with delayed planting to be greatest for the full-season hybrids, less for the mid-season hybrids, and least affected for the short-season hybrids. But in this study with different short-season hybrids, yield decreases were similar to those caused by planting delays of the mid- and full-season hybrids.

**Emergence, Tassel, and Silk Dates:** Number of days required for corn emergence decreased as planting was delayed (Table 3). Late April planted corn required approximately 23 days for emergence while only 14 days were required for the mid-May planting date and late May planting date required 9 to 13 days for emergence.

For all relative maturity groups, tasseling and silking occurred 4 to 5 days earlier for late April planting compared with mid-May planting at both Lamberton and Waseca (Table 4) while at Morris, the difference was only 0 to 2 days for all hybrids. Comparing the mid-May and late-May planting dates, the tasseling and silking difference was 4 to 5 days for both Lamberton and Waseca and 8 to 10 days at Morris. With early planting of full-season hybrids, pollination can be as early as mid-July.

**Ear Moisture Content:** Calendar dates when ears reached 30 percent moisture content are given in Table 5 for three planting dates and three relative maturities at each location. When ear moisture content is 30 percent, kernel moisture content is approximately 26 percent; the moisture content which results in minimum grain loss during harvest. As with pollination, earlier planting results in plants reaching physiological maturity and harvest maturity sooner.

Ear moisture profiles for the three planting dates are given in Figures 1, 2, and 3 for the three locations. Within a location, drying rates are similar for each planting date. For any given calendar date, the moisture level is lowest for the earliest planting date and highest for the last planting date.

### HYBRID MATURITY

**Grain Yield:** When averaged over the 3 years, there was little yield difference between the full-season (110-115 RM) and mid-season (100-105 RM) hybrids at Lamberton and Waseca (Table 6). The same was true for the comparison between 100-105 RM and 90-95 RM groups at Morris. The early fall frost in 1974 and the dry growing season of 1975 partially accounted for the lower yield level of the full-season hybrids. Single year yields are given in Tables 7, 8, and 9. Considerable variation in yield performance of full- and mid-season hybrids occurred for the 9 location-years. Only in 2 of the location-years did the full-season hybrids yield at least 5 bu/a higher than the mid-season hybrids (averaged over starter and no-starter fertilizer). However, in 2 of the 9 location-years, the full-season hybrids yielded 5 bu/a lower than the mid-season hybrids.

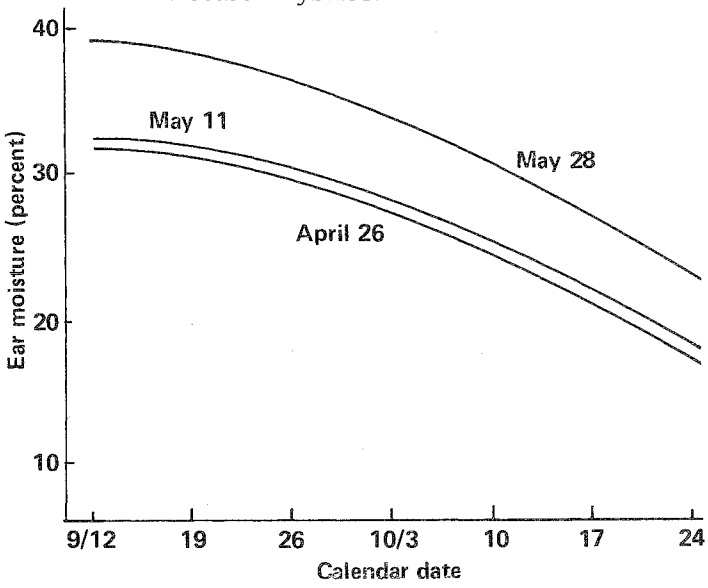


**Figure 1. Effect of three planting dates on ear moisture content, Morris, 1973.**

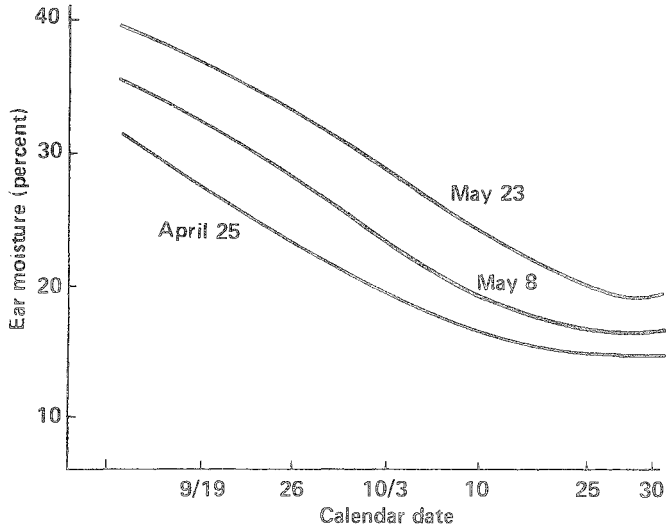


Figure 2. Effect of three planting dates on ear moisture content, Lamberton, 1973.

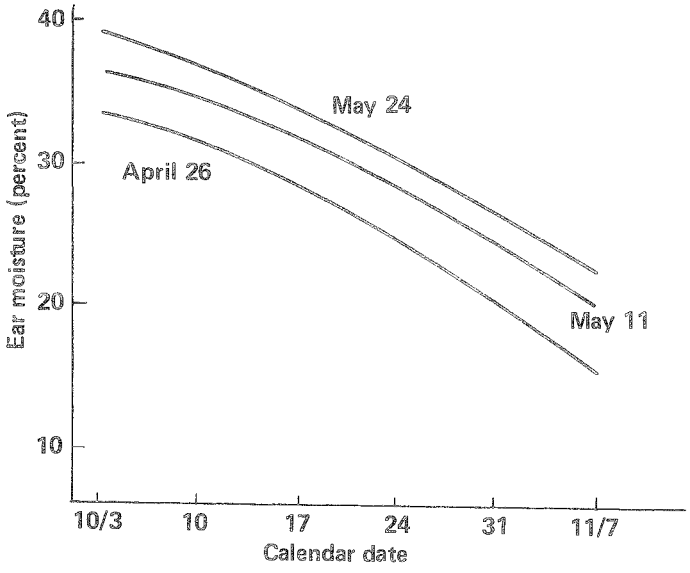


Figure 3. Effect of three planting dates on ear moisture content, Waseca, 1973.

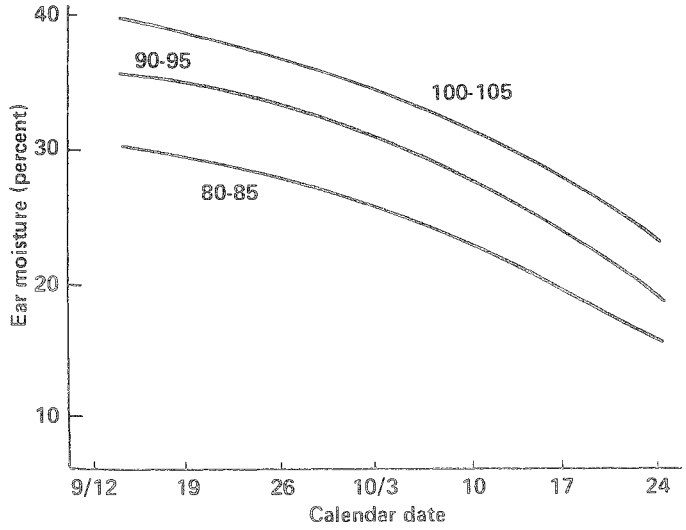


Figure 4. Effect of three hybrid relative maturity groups on ear moisture content, Morris, 1973.

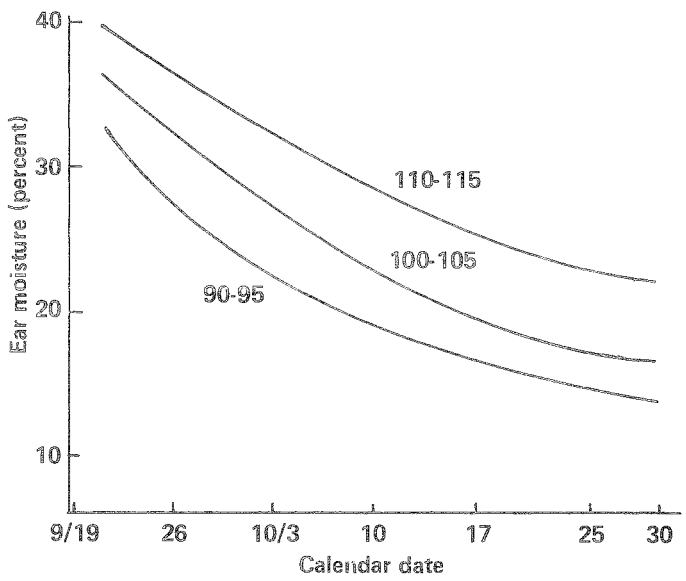


Figure 5. Effect of three hybrid relative maturity groups on ear moisture content, Lamberton, 1973.

In 3 of the 9 location-years, the mid-season hybrids yielded at least 5 bu/a higher than the short season hybrids (Tables 7, 8, and 9). Greatest yield differences between mid- and short-season hybrids occurred at Lamberton and Waseca while little difference occured at Morris.

**Tassel and Silk Dates:** Tassel and silk dates for the three relative maturity groups are given in Table 4 for each planting date and location. Tasseling and silking occurred first for the short-season hybrids, next for the mid-season hybrids, and last for the full-season hybrids. Since weather conditions at pollination affect both pollen viability and silk receptivity, it is a good practice to plan for pollination to occur over a range of calendar dates before the occurrence of high air temperatures. This can be accomplished by varying both planting date and hybrid maturity as demonstrated in Table 4.

**Ear Moisture:** As with tassel and silk dates, short-season hybrids reached 30 percent ear moisture content at an earlier calendar date than mid-season and/or full-season hybrids for all planting date-location combinations (Table 5). Ear moisture profiles for the relative maturity groups are given in Figures 4, 5, and 6 for the three locations. While the profiles are different for each location, they are similar within a location for the three maturities. However, for any given calendar date, the short-season hybrids have a lower ear moisture level than the mid-season hybrids which in turn have a lower moisture content than full-season hybrids.

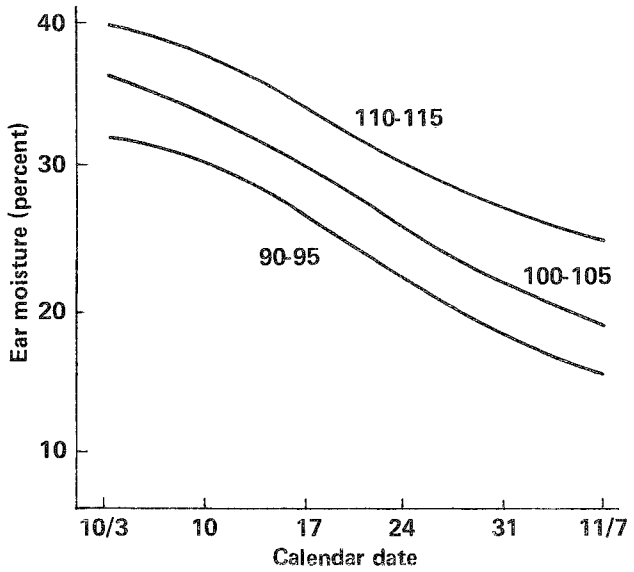


**Figure 6. Effect of three hybrid relative maturity groups on ear moisture content, Waseca, 1973.**

## STARTER FERTILIZER

**Grain Yield:** Application of starter fertilizer increased corn grain yield in 4 of the 9 location-years compared to no starter fertilizer (Table 10). Two of these increases occurred at Lamberton in 1973 and 1974 and one at each of the other locations. Yield increases were small (0 to 6 bu/a) and generally would not have paid for the fertilizer. When averaged over 3 years, yield differences in favor of starter fertilizer were 1, 1, and 3 bu/a for the three locations (Table 10) on soils testing medium and high in phosphorus and potassium.

**Early Vegetative Growth:** Starter fertilizer increased early plant height and dry weight in 8 of the 9 location-year comparisons (Table 11). Plant height was not changed at Morris in 1974 nor was dry weight at Morris in 1973. Dry weight and plant height of young corn plants were consistently increased by the application of starter fertilizer at all locations. Since grain yield was not consistently increased by starter fertilizer, early plant size is not a good indication of final grain yield.

## PLANT NUTRIENT ANALYSIS

Plant analysis measures inorganic nutrients at a specific stage of growth. It cannot diagnose problems of plant diseases, soil aeration, or weather stress, which may limit yields. Plant analysis can be useful to farmers, but cannot supply unlimited information in breaking yield barriers.

Nutrient status of soils used in the experiments were high and perhaps suitable for producing maximum corn yields. The fact that some hybrids are lower than others in a certain nutrient is of interest, but since all hybrids had nutrients well above the sufficient supply, very little importance can be attached to this. Perhaps if soil nutrients were at or below threshold levels, the hybrid more capable of absorbing certain nutrients may demonstrate superiority.

In general, plant nutrients, soil nutrients, and fertilizer treatments, when added as needed, relate very well. Farmers can use plant analysis to determine further need for building soil fertility and in trouble-shooting problem areas.

Since many elements need to be studied in plant analysis, it is difficult to determine the best time for sampling. Early growth sampling shows greater differences than tasseling time testing, but does not necessarily relate better to final yield. Scientists in corn plant analysis throughout the corn growing areas have selected tasseling time as most suitable for all elements.

The effect of planting date, starter fertilizer, hybrid maturity, and sampling date on nutrient concentration can be seen in Tables 12 through 17 which give emission spectrograph data for 1974 and 1975 for the production factors studied. 1973 data were published earlier[1]. Nutrient concentration was very little affected by any of these factors. Where statistically significant differences occurred, they were small and inconsistent.

## Conclusions

1. The yield of all three maturity groups declined at all locations as planting was delayed.
2. The number of days between planting and emergence decreased as planting was delayed, but early planting resulted in the earliest date of emergence.
3. Full- and mid-season hybrids yielded about the same at all locations. Mid-season hybrids outyielded short-season hybrids at Lamberton and Waseca, but not at Morris.
4. Tasseling and silking occurred first for short-season hybrids, next for mid-season hybrids, and last for full-season hybrids.
5. Yield increases due to starter fertilizer were small (0 to 6 bu/a) and not statistically significant.
6. In most cases starter fertilizer increased early plant height and dry weight, but there was no correlation between early growth and grain yield.
7. For any given calendar date during the harvest period, the lowest ear moisture resulted from early planting and/or the use of short-season hybrids.
8. Drying rates at all locations were comparable for the differing maturities and planting dates.
9. Nutrient concentrations of whole plants sampled when 12 inches in height and the ear leaf sampled at silking were little affected by planting date, starter fertilizer, and/or hybrid maturity.

[1]Overdahl, C. J., et al. 1974. Plant Nutrient Analyses From Corn Management Studies. Miscellaneous Report 127. Agricultural Experiment Station, University of Minnesota.

**Table 1. Planting dates, soil test results, fertilizer applications, and weather information for Lamberton, Morris, and Waseca, 1973-75.**

| Planting dates | Lamberton | | | Morris | | | Waseca | | |
|---|---|---|---|---|---|---|---|---|---|
| | 1973 | 1974 | 1975 | 1973 | 1974 | 1975 | 1973 | 1974 | 1975 |
| 1 | 4/25 | 4/24 | 5/2 | 4/26 | 4/25 | 5/8 | 4/26 | 4/25 | — |
| 2 | 5/8 | 5/16 | 5/13 | 5/11 | 5/17 | 5/23 | 5/11 | 5/17 | 5/10 |
| 3 | 5/23 | 5/29 | 5/27 | 5/28 | 5/28 | 6/10 | 5/24 | 5/28 | 5/23 |
| Soil tests | | | | | | | | | |
| pH | 5.9 | 5.8 | 7.0 | 8.1 | 7.8 | 8.0 | 6.2 | 6.6 | 6.2 |
| P (lb/a) | 25 | 33 | 35 | 31[1] | 41 | 17 | 60 | 44 | 40 |
| K (lb/a) | 200 | 240 | 210 | 420 | 240 | 280 | 300 | 205 | 140 |
| Fertilizer rates lb/a | | | | | | | | | |
| Nitrogen | 100 | 100 | 100 | 100 | 110 | 110 | 200 | 175 | 160 |
| Bdct $P_2O_5$ | 78 | 78 | 77 | — | — | — | 60 | 40 | — |
| Bdct $K_2O$ | 78 | 78 | — | — | — | — | 90 | 40 | 60 |
| Starter[2] | 12+40+20 | | | 10+40+20 | | | 13+32+42 | | |
| Weather information for growing season, May 1—September 30 | | | | | | | | | |
| GDD[3] | 2574 | 2445 | 2634 | 2317 | 2088 | 2284 | 2531 | 2207 | 2329 |
| Rainfall (inches) | 11.66 | 11.67 | 9.66 | 14.35 | 14.38 | 16.40 | 24.16 | 16.96 | 14.10 |

[1] All phosphorus values at Morris determined on a 1:50 soil to solution ratio.
[2] These figures represent the average amount of $N+P_2O_5+K_2O$ applied annually in the starter fertilizer at each location.
[3] GDD=Growing Degree Days.

$$GDD=\sum\left[\left(\frac{\text{Max. temp. }(\leq 86)+\text{Min. temp. }(\geq 50)}{2}\right)-50\right]$$

**Table 2. Effect of planting date on corn grain yield at three locations, 1973-75, averaged over hybrids and fertilizer treatments.**

| Planting date[1] | Morris | | Lamberton | Waseca | |
|---|---|---|---|---|---|
| | 74-75[2] | 73-75 | 73-75 | 73-74[3] | 73-75 |
| | Bushels per acre | | | | |
| 1 | 114 | — | 104 | 133 | — |
| 2 | 114 | 122 | 97 | 118 | 124 |
| 3 | 98 | 108 | 85 | 110 | 110 |

[1]Calendar dates are given in Table 1 for each location.
[2]Plots of the 80-85 RM hybrids planted date 1 were not harvested in 1973 due to poor stands.
[3]Plots were not planted on date 1 in 1975 because of wet soil.

**Table 3. Effect of planting date on the number of days between planting and emergence for three locations, 1973.**

| Location | Planting Date[1] | | |
|---|---|---|---|
| | 1 | 2 | 3 |
| | Days | | |
| Lamberton | 23 | 14 | 11 |
| Morris | 24 | 15 | 9 |
| Waseca | 23 | 14 | 13 |

[1]See Table 1 for calendar dates.

**Table 4. Tasseling and silking dates for three locations, three relative maturity groups, and three planting dates, 1973.**

| Location | Relative Maturity | Planting date | | | | | |
|---|---|---|---|---|---|---|---|
| | | Tassel[1] | Silk[2] | Tassel | Silk | Tassel | Silk |
| | | July | | | | | |
| Lamberton | | April 25 | | May 8 | | May 23 | |
| | 110-115 | 17 | 19 | 21 | 22 | 26 | 28 |
| | 100-105 | 16 | 18 | 20 | 22 | 24 | 27 |
| | 90-95 | 13 | 16 | 17 | 19 | 22 | 24 |
| Morris | | April 26 | | May 11 | | May 28 | |
| | 100-105 | 22 | 24 | 22 | 24 | 31 | 3[3] |
| | 90-95 | 19 | 22 | 20 | 23 | 28 | 2[3] |
| | 80-85 | 16 | 18 | 17 | 20 | 25 | 28 |
| Waseca | | April 26 | | May 11 | | May 24 | |
| | 110-115 | 22 | 22 | 27 | 27 | 31 | 31 |
| | 100-105 | 21 | 21 | 25 | 25 | 29 | 29 |
| | 90-95 | 18 | 19 | 23 | 24 | 27 | 27 |

[1]Calendar date when 50 percent of plants have fully developed tassel.
[2]Calendar date when 50 percent of plants have silks emerged.
[3]August dates.

**Table 5. Calendar date when ears reached 30 percent moisture content for three locations, three planting dates, and three relative maturity groups, 1973.**

| Location | Relative Maturity | Planting date | | |
|---|---|---|---|---|
| Lamberton | | April 25 | May 8 | May 23 |
| | 110-115 | Oct. 3 | Oct. 11 | Oct. 17 |
| | 100-105 | Sept. 22 | Sept. 29 | Oct. 11 |
| | 90-95 | Sept. 9 | Sept. 22 | Sept. 28 |
| Morris | | April 26 | May 11 | May 28 |
| | 100-105 | Oct. 7 | Oct. 8 | Oct. 21 |
| | 90-95 | Sept. 23 | Sept. 23 | Oct. 15 |
| | 80-85 | Sept. 14 | Sept. 14 | Sept. 29 |
| Waseca | | April 26 | May 11 | May 24 |
| | 110-115 | Oct. 18 | Oct. 23 | Oct. 30 |
| | 100-105 | Oct. 11 | Oct. 15 | Oct. 18 |
| | 90-95 | Oct. 3 | Oct. 6 | Oct. 14 |

**Table 6. Effect of hybrid maturity on corn grain yield at three locations, 1973-75, averaged over planting dates and fertilizer treatments.**

| Relative maturity | Morris | | Lamberton | Waseca | |
|---|---|---|---|---|---|
| | 74-75[1] | 73-75[2] | 73-75 | 73-74[1] | 73-75[3] |
| | Bushels per acre | | | | |
| 110-115 | — | — | 98 | 124 | 120 |
| 100-105 | 109 | 118 | 98 | 123 | 118 |
| 90-95 | 110 | 115 | 90 | 113 | 112 |
| 80-85 | 107 | 112 | — | — | — |

[1]Mean over fertilizer treatments and all three planting dates.
[2]Mean over fertilizer treatments and last two planting dates (80-85 RM hybrid plots planted on date 1 were not harvested in 1973 because of poor stands).
[3]Mean over fertilizer treatments and last two planting dates (plots were not planted on date 1 in 1975 because of wet soil).

**Table 7. Corn grain yields of three hybrid maturity groups planted on three dates with no-starter and starter fertilizer treatments at Morris, 1973-75.**

| Relative maturity | Planting date[1] | No starter 73 | No starter 74 | No starter 75 | Starter[2] 73 | Starter[2] 74 | Starter[2] 75 | Average over years and fertilizer treatments 74-75 | Average over years and fertilizer treatments 73-75 |
|---|---|---|---|---|---|---|---|---|---|
| | | Bushels per acre | | | | | | | |
| 100-105 | 1 | 150 | 98 | 140 | 156 | 93 | 140 | 118 | —[3] |
| | 2 | 148 | 93 | 134 | 148 | 92 | 131 | 112 | 124 |
| | 3 | 139 | 77 | 112 | 140 | 79 | 119 | 97 | 111 |
| Average over dates | | 146 | 89 | 129 | 148 | 88 | 130 | | |
| 90-95 | 1 | 141 | 99 | 136 | 145 | 95 | 139 | 117 | — |
| | 2 | 135 | 102 | 130 | 140 | 97 | 133 | 116 | 123 |
| | 3 | 128 | 84 | 108 | 126 | 84 | 114 | 98 | 107 |
| Average over dates | | 135 | 95 | 125 | 137 | 92 | 129 | | |
| 80-85 | 1 | — | 92 | 126 | — | 85 | 131 | 108 | — |
| | 2 | 129 | 97 | 133 | 130 | 97 | 130 | 114 | 119 |
| | 3 | 116 | 83 | 110 | 118 | 84 | 118 | 99 | 105 |
| Average over dates | | 122 | 91 | 123 | 124 | 89 | 126 | | |
| Average over dates and maturities | | 134 | 92 | 126 | 136 | 90 | 128 | | |

[1]See Table 1 for calendar dates.
[2]See Table 1 for rate and analysis of starter fertilizer.
[3]Missing values are the result of not harvesting the 80-85 RM hybrids planted on date 1 in 1973.

**Table 8. Corn grain yields of three hybrid maturity groups planted at three dates with no-starter and starter fertilizer treatments at Lamberton, 1973-75.**

| Relative maturity | Planting date[1] | No starter 73 | No starter 74 | No starter 75 | Starter[2] 73 | Starter[2] 74 | Starter[2] 75 | Average over years and fertilizer treatments |
|---|---|---|---|---|---|---|---|---|
| | | Bushels per acre | | | | | | |
| 110-115 | 1 | 118 | 105 | 90 | 119 | 112 | 95 | 106 |
| | 2 | 110 | 94 | 87 | 118 | 102 | 93 | 101 |
| | 3 | 100 | 85 | 81 | 99 | 88 | 70 | 87 |
| Average over dates | | 109 | 95 | 86 | 112 | 101 | 86 | |
| 100-105 | 1 | 113 | 100 | 93 | 116 | 111 | 95 | 105 |
| | 2 | 118 | 93 | 91 | 112 | 98 | 89 | 100 |
| | 3 | 87 | 83 | 88 | 96 | 88 | 89 | 88 |
| Average over dates | | 106 | 92 | 91 | 108 | 99 | 91 | |
| 90-95 | 1 | 110 | 101 | 86 | 109 | 109 | 93 | 101 |
| | 2 | 105 | 94 | 69 | 104 | 100 | 70 | 90 |
| | 3 | 83 | 82 | 76 | 92 | 80 | 65 | 80 |
| Average over dates | | 99 | 92 | 77 | 102 | 96 | 76 | |
| Average over dates and maturities | | 105 | 93 | 85 | 107 | 99 | 84 | |
| 3-year average over dates and maturities | | | 94 | | | 97 | | |

[1]See Table 1 for calendar dates.
[2]See Table 1 for rate and analysis of starter fertilizer.

**Table 9. Corn grain yields of three hybrid maturity groups planted at three dates with no-starter and starter fertilizer treatments at Waseca, 1973-75.**

| Relative maturity | Planting date[1] | No starter 73 | No starter 74 | No starter 75 | Starter[2] 73 | Starter[2] 74 | Starter[2] 75 | Average over years and fertilizer treatments 73-74 | Average over years and fertilizer treatments 73-75 |
|---|---|---|---|---|---|---|---|---|---|
| | | Bushels per acre | | | | | | | |
| 110-115 | 1 | 160 | 116 | —[3] | 154 | 121 | — | 138 | — |
| | 2 | 150 | 95 | 145 | 137 | 99 | 145 | 120 | 128 |
| | 3 | 147 | 83 | 114 | 140 | 82 | 112 | 113 | 113 |
| Average over dates | | 152 | 98 | 130 | 144 | 101 | 128 | | |
| 100-105 | 1 | 167 | 116 | — | 161 | 114 | — | 140 | — |
| | 2 | 135 | 100 | 129 | 138 | 106 | 133 | 120 | 124 |
| | 3 | 140 | 84 | 110 | 131 | 88 | 117 | 117 | 112 |
| Average over dates | | 147 | 100 | 120 | 143 | 103 | 125 | | |
| 90-95 | 1 | 139 | 98 | — | 140 | 106 | — | 121 | — |
| | 2 | 131 | 93 | 128 | 135 | 97 | 132 | 114 | 119 |
| | 3 | 132 | 83 | 107 | 125 | 81 | 111 | 105 | 106 |
| Average over dates | | 134 | 91 | 118 | 133 | 95 | 122 | | |
| Average over dates and maturities | | 144 | 96 | 123 | 140 | 100 | 125 | | |

[1]See Table 1 for calendar dates.
[2]See Table 1 for rate and analysis of starter fertilizer.
[3]Missing values are the result of date 1 not being planted in 1975.

**Table 10. Effect of starter fertilizer on corn grain yield at three locations and three years, averaged over planting dates and hybrids.**

| Location | Fertilizer | 1973 | 1974 | 1975 | Average |
|---|---|---|---|---|---|
| | | Bushels per acre | | | |
| Morris | Starter[1] | 136 | 90 | 128 | 118 |
| | No starter | 134 | 92 | 126 | 117 |
| | | ns | ns | * | |
| Lamberton | Starter | 107 | 99 | 84 | 97 |
| | No starter | 105 | 93 | 85 | 94 |
| | | * | * | ns | |
| Waseca | Starter | 140 | 100 | 125 | 122 |
| | No starter | 144 | 96 | 123 | 121 |
| | | ns | * | ns | |

[1]See Table 1 for rate and analysis of starter fertilizer applied at each location.
*=statistically different; ns=not statistically different.

**Table 11. Effect of starter fertilizer on early plant height and dry weight at three locations and three years, averaged over planting dates and hybrids.**

| Location | Fertilizer | Plant height 1973 | Plant height 1974 | Plant height 1975 | Dry weight 1973 | Dry weight 1974 | Dry weight 1975 |
|---|---|---|---|---|---|---|---|
| | | Centimeters | | | Grams/10 plants | | |
| Morris | Starter[1] | 37.2 | 18.4 | 23.1 | 20.2 | 33.2 | 51.4 |
| | No starter | 34.2 | 18.1 | 21.8 | 19.9 | 25.7 | 43.1 |
| | | * | ns | * | ns | * | * |
| Lamberton | Starter | 20.8 | 25.3 | 26.2 | 34.9 | 95.6 | 63.1 |
| | No starter | 18.2 | 22.6 | 23.5 | 23.3 | 71.4 | 49.1 |
| | | * | * | * | * | * | * |
| Waseca | Starter | 53.1 | 23.3 | 26.4 | 77.5 | 47.0 | 48.2 |
| | No starter | 35.6 | 22.1 | 24.3 | 61.0 | 42.7 | 38.1 |
| | | * | * | * | * | * | * |

[1]See Table 1 for rate and analysis of starter fertilizer applied at each location.
ns = not statistically different; * = statistically different.

**Table 12. The effect of planting date, starter fertilizer, and hybrid maturity on nutrient concentration of corn at two stages of growth (whole plant at 12-inch corn height and ear leaf at tasseling time): Morris, 1974.**

| | percent | | | | ppm | | | | | Corn yield |
|---|---|---|---|---|---|---|---|---|---|---|
| | P | K | Ca | Mg | Fe | Zn | Cu | Mn | B | bu/a |
| | percent | | | | ppm | | | | | Corn yield |
| | P | K | Ca | Mg | Fe | Zn | Cu | Mn | B | bu/a |
| | Whole plant, 12-inch height | | | | | | | | | |
| Planting date[1] | | | | | | | | | | |
| April 25 | .46 | 4.16 | .68 | .70 | 287 | 47 | 11 | 111 | 11 | 95 |
| May 17 | .45 | 4.31 | .62 | .66 | 294 | 42 | 11 | 109 | 12 | 96 |
| May 28 | .43 | 4.27 | .62 | .61 | 256 | 46 | 11 | 109 | 11 | 82 |
| LSD, 5 percent* | ns | ns | ns | ns | ns | ns | ns | ns | ns | |
| Starter[2] | | | | | | | | | | |
| None | .44 | 4.14 | .65 | .68 | 274 | 46 | 11 | 110 | 11 | 91 |
| 8-33-17, 120 lb/a | .45 | 4.35 | .62 | .63 | 285 | 44 | 11 | 110 | 11 | 90 |
| LSD, 5 percent* | ns | ns | .03 | .02 | ns | 2 | ns | ns | ns | |
| Hybrid relative maturity[3] | | | | | | | | | | |
| 105 | .45 | 4.40 | .71 | .67 | 264 | 45 | 11 | 130 | 11 | 86 |
| 105 | .45 | 4.24 | .65 | .61 | 283 | 44 | 11 | 127 | 12 | 85 |
| 100 | .42 | 3.92 | .69 | .59 | 276 | 46 | 11 | 97 | 11 | 95 |
| 95 | .43 | 4.41 | .69 | .71 | 264 | 42 | 11 | 93 | 11 | 88 |
| 95 | .47 | 4.41 | .57 | .74 | 286 | 43 | 12 | 114 | 10 | 101 |
| 90 | .45 | 4.25 | .62 | .67 | 260 | 44 | 12 | 116 | 12 | 91 |
| 85 | .46 | 4.16 | .59 | .59 | 294 | 50 | 11 | 95 | 11 | 84 |
| 80 | .45 | 4.21 | .62 | .69 | 287 | 45 | 12 | 115 | 12 | 91 |
| 80 | .41 | 4.22 | .62 | .63 | 299 | 48 | 8 | 106 | 11 | 97 |
| LSD, 5 percent* | .02 | .29 | .04 | .05 | ns | 3 | 1 | 8 | 1 | |
| Sufficient quantity | .40 | 3.0 | .30 | .30 | 50 | 20 | 7 | 50 | 7 | |
| | Ear leaf at tasseling | | | | | | | | | |
| Planting date[1] | | | | | | | | | | |
| April 25 | .33 | 2.02 | .63 | .78 | 238 | 32 | 14 | 116 | 9 | 95 |
| May 17 | .33 | 2.12 | .59 | .73 | 237 | 30 | 14 | 114 | 9 | 96 |
| May 28 | .32 | 2.14 | .61 | .74 | 249 | 32 | 14 | 107 | 9 | 82 |
| LSD, 5 percent* | ns | ns | ns | ns | ns | ns | ns | ns | ns | |
| Starter[2] | | | | | | | | | | |
| None | .32 | 2.07 | .61 | .75 | 239 | 31 | 14 | 112 | 9 | 91 |
| 8-33-17, 120 lb/a | .33 | 2.12 | .61 | .75 | 244 | 31 | 14 | 112 | 9 | 90 |
| LSD, 5 percent* | .01 | ns | ns | ns | ns | ns | ns | ns | ns | |
| Hybrid relative maturity[3] | | | | | | | | | | |
| 105 | .31 | 2.23 | .67 | .71 | 203 | 31 | 12 | 96 | 9 | 86 |
| 105 | .30 | 2.10 | .59 | .72 | 219 | 25 | 15 | 89 | 9 | 85 |
| 100 | .30 | 2.20 | .56 | .59 | 235 | 35 | 15 | 85 | 9 | 95 |
| 95 | .32 | 2.01 | .57 | .81 | 225 | 27 | 14 | 73 | 8 | 88 |
| 95 | .35 | 2.08 | .51 | .82 | 239 | 27 | 14 | 114 | 8 | 101 |
| 90 | .33 | 1.86 | .67 | .80 | 243 | 33 | 15 | 139 | 9 | 91 |
| 85 | .37 | 2.11 | .63 | .80 | 272 | 39 | 14 | 136 | 9 | 84 |
| 80 | .34 | 1.79 | .64 | .76 | 254 | 33 | 14 | 115 | 10 | 91 |
| 80 | .35 | 2.45 | .63 | .74 | 282 | 31 | 14 | 161 | 9 | 97 |
| LSD, 5 percent* | .01 | .14 | .04 | .07 | 14 | 2 | 1 | 8 | 1 | |
| Sufficient quantity | .25 | 1.71 | .21 | .21 | 21 | 20 | 6 | 21 | 4 | |

[1]Mean over all hybrids and starter treatments for planting date.
[2]Mean over all hybrids and planting dates for starter.
[3]Mean over all planting dates and starter for individual hybrids.
*When means are different by an amount equal to or greater than the LSD they are statistically different at the 95 percent level of confidence.
ns = not statistically different.

**Table 13. The effect of planting date, starter fertilizer, and corn hybrids on nutrient concentration of corn at two stages of growth (whole plant at 12-inch corn height and ear leaf at tasseling time): Lamberton, 1974.**

| | percent | | | | ppm | | | | | Corn yield |
|---|---|---|---|---|---|---|---|---|---|---|
| | P | K | Ca | Mg | Fe | Zn | Cu | Mn | B | bu/a |
| | percent | | | | ppm | | | | | Corn yield |
| | P | K | Ca | Mg | Fe | Zn | Cu | Mn | B | bu/a |
| | Whole plant, 12-inch height | | | | | | | | | |
| Planting date[1] | | | | | | | | | | |
| April 24 | .61 | 5.34 | .55 | .43 | 906 | 31 | 10 | 90 | 14 | 106 |
| May 16 | .40 | 4.71 | .47 | .37 | 397 | 28 | 10 | 56 | 12 | 94 |
| May 29 | .40 | 4.66 | .46 | .38 | 294 | 32 | 11 | 58 | 11 | 84 |
| LSD, 5 percent* | .04 | ns | ns | .02 | 412 | ns | ns | 10 | ns | |
| Starter[2] | | | | | | | | | | |
| None | .47 | 4.86 | .48 | .39 | 519 | 32 | 11 | 65 | 12 | 93 |
| 8-24-12, 120 lb/a | .47 | 4.95 | .51 | .40 | 545 | 28 | 10 | 70 | 12 | 99 |
| LSD, 5 percent* | ns | ns | ns | ns | ns | ns | ns | ns | ns | |
| Hybrid relative maturity[3] | | | | | | | | | | |
| 115 | .46 | 4.78 | .47 | .37 | 528 | 31 | 9 | 60 | 13 | 94 |
| 110 | .49 | 4.90 | .51 | .41 | 601 | 32 | 12 | 78 | 13 | 103 |
| 110 | .45 | 5.05 | .45 | .38 | 529 | 30 | 10 | 72 | 13 | 96 |
| 105 | .48 | 5.08 | .56 | .41 | 533 | 32 | 10 | 73 | 12 | 97 |
| 105 | .47 | 4.89 | .48 | .38 | 567 | 30 | 11 | 73 | 12 | 91 |
| 100 | .45 | 4.91 | .52 | .35 | 503 | 31 | 11 | 61 | 11 | 98 |
| 95 | .47 | 4.89 | .55 | .43 | 511 | 30 | 11 | 67 | 12 | 97 |
| 95 | .49 | 4.87 | .43 | .44 | 469 | 32 | 11 | 58 | 11 | 100 |
| 90 | .47 | 4.77 | .47 | .39 | 549 | 26 | 10 | 68 | 13 | 88 |
| LSD, 5 percent* | .01 | .20 | .01 | .01 | ns | 16 | ns | 3 | 1 | |
| Sufficient quantity | .40 | 3.0 | .30 | .30 | 50 | 20 | 7 | 50 | 7 | |
| | Ear leaf at tasseling | | | | | | | | | |
| Planting date[1] | | | | | | | | | | |
| April 24 | .27 | 2.16 | .92 | .56 | 323 | 20 | 14 | 53 | 15 | 106 |
| May 16 | .27 | 2.35 | .79 | .52 | 285 | 22 | 13 | 49 | 13 | 94 |
| May 29 | .27 | 2.33 | .78 | .54 | 281 | 23 | 12 | 49 | 12 | 84 |
| LSD, 5 percent* | ns | .10 | ns | ns | ns | ns | ns | ns | ns | |
| Starter[2] | | | | | | | | | | |
| None | .27 | 2.37 | .82 | .54 | 185 | 22 | 13 | 50 | 13 | 93 |
| 8-24-12, 120 lb/a | .27 | 2.19 | .84 | .55 | 187 | 21 | 13 | 50 | 13 | 99 |
| LSD, 5 percent* | ns | ns | ns | ns | ns | ns | ns | ns | ns | |
| Hybrid relative maturity[3] | | | | | | | | | | |
| 115 | .28 | 2.72 | .80 | .52 | 323 | 28 | 14 | 53 | 13 | 94 |
| 110 | .26 | 2.36 | .89 | .55 | 278 | 18 | 12 | 50 | 15 | 103 |
| 110 | .25 | 2.37 | .80 | .55 | 315 | 23 | 13 | 68 | 15 | 96 |
| 105 | .27 | 2.42 | .87 | .54 | 365 | 23 | 11 | 48 | 12 | 97 |
| 105 | .27 | 2.27 | .76 | .52 | 284 | 17 | 15 | 45 | 15 | 91 |
| 100 | .26 | 2.32 | .84 | .41 | 289 | 25 | 14 | 38 | 13 | 98 |
| 95 | .27 | 2.04 | .85 | .60 | 282 | 21 | 13 | 43 | 10 | 97 |
| 95 | .30 | 2.17 | .74 | .61 | 311 | 18 | 12 | 47 | 12 | 100 |
| 90 | .27 | 1.84 | .91 | .57 | 320 | 23 | 13 | 59 | 15 | 88 |
| LSD, 5 percent* | .01 | .15 | .03 | .02 | 18 | 2 | ns | 3 | 1 | |
| Sufficient quantity | .25 | 1.71 | .21 | .21 | 21 | 20 | 6 | 21 | 4 | |

[1]Mean over all hybrids and starter treatments for planting date.
[2]Mean over all hybrids and planting dates for starter.
[3]Mean over all planting dates and starter for individual hybrids.
*When means are different by an amount equal to or greater than the LSD they are statistically different at the 95 percent level of confidence.
ns = not statistically different.

**Table 14. The effect of planting date, starter fertilizer, and corn hybrids on nutrient concentration of corn at two stages of growth. (whole plant at 12-inch corn height and ear leaf at tasseling time): Waseca, 1974.**

| | percent | | | | ppm | | | | | Corn yield |
|---|---|---|---|---|---|---|---|---|---|---|
| | P | K | Ca | Mg | Fe | Zn | Cu | Mn | B | bu/a |
| | Whole plant, 12-inch height | | | | | | | | | |
| Planting date[1] | | | | | | | | | | |
| April 25 | .66 | 4.09 | .83 | .48 | 1337 | 37 | 8 | 84 | 19 | 112 |
| May 17 | .56 | 4.10 | .57 | .42 | 908 | 34 | 8 | 65 | 12 | 99 |
| May 28 | .4 | 4.22 | .63 | .46 | 343 | 27 | 6 | 54 | 11 | 84 |
| LSD, 5 percent* | .03 | ns | .06 | ns | 230 | 4 | 1 | 9 | 2 | |
| Starter[2] | | | | | | | | | | |
| None | .53 | 3.91 | .68 | .47 | 855 | 35 | 8 | 67 | 14 | 96 |
| 9-23-30, 140 lb/a | .56 | 4.36 | .67 | .44 | 871 | 31 | 7 | 69 | 14 | 99 |
| LSD, 5 percent* | .01 | .09 | ns | .01 | ns | 1 | 1 | ns | ns | |
| Hybrid relative maturity[3] | | | | | | | | | | |
| 115 | .53 | 3.90 | .67 | .40 | 910 | 31 | 8 | 59 | 16 | 99 |
| 110 | .55 | 4.14 | .68 | .46 | 855 | 37 | 7 | 72 | 15 | 103 |
| 110 | .50 | 4.17 | .62 | .45 | 938 | 35 | 7 | 74 | 14 | 96 |
| 105 | .56 | 4.28 | .74 | .45 | 818 | 34 | 7 | 73 | 14 | 103 |
| 105 | .55 | 4.24 | .66 | .43 | 882 | 34 | 7 | 76 | 14 | 96 |
| 100 | .53 | 4.17 | .68 | .41 | 792 | 33 | 7 | 55 | 14 | 105 |
| 95 | .55 | 4.02 | .74 | .51 | 848 | 32 | 9 | 65 | 15 | 98 |
| 95 | .59 | 4.17 | .62 | .52 | 871 | 33 | 8 | 68 | 13 | 93 |
| 90 | .53 | 4.12 | .67 | .46 | 850 | 31 | 7 | 67 | 14 | 88 |
| LSD, 5 percent* | .02 | ns | .03 | .04 | ns | 3 | 2 | 7 | 1 | |
| Sufficient quantity | .40 | 3.0 | .30 | .30 | 50 | 20 | 7 | 50 | 7 | |
| | Ear leaf at tasseling | | | | | | | | | |
| Planting date[1] | | | | | | | | | | |
| April 25 | .28 | 1.85 | .86 | .63 | 221 | 18 | 13 | 37 | 14 | 112 |
| May 17 | .28 | 1.86 | .81 | .62 | 196 | 21 | 12 | 36 | 13 | 99 |
| May 28 | .29 | 2.25 | .78 | .56 | 199 | 23 | 12 | 36 | 11 | 84 |
| LSD, 5 percent* | ns | .26 | .0 | ns | 7 | ns | ns | ns | 1 | |
| Starter[2] | | | | | | | | | | |
| None | .29 | 1.98 | .82 | .62 | 210 | 21 | 13 | 37 | 13 | 96 |
| 9-23-30, 140 lb/a | .28 | 2.00 | .82 | .59 | 201 | 20 | 11 | 36 | 12 | 99 |
| LSD, 5 percent* | ns | ns | ns | ns | ns | ns | ns | ns | ns | |
| Hybrid relative maturity[3] | | | | | | | | | | |
| 115 | .27 | 1.99 | .82 | .58 | 208 | 20 | 12 | 34 | 11 | 99 |
| 110 | .28 | 2.11 | .86 | .64 | 197 | 20 | 11 | 33 | 13 | 103 |
| 110 | .26 | 1.96 | .76 | .62 | 208 | 21 | 11 | 48 | 13 | 96 |
| 105 | .29 | 2.10 | .87 | .59 | 177 | 21 | 12 | 33 | 11 | 103 |
| 105 | .30 | 2.30 | .81 | .59 | 207 | 20 | 16 | 33 | 13 | 96 |
| 100 | .27 | 2.02 | 79 | .47 | 213 | 22 | 12 | 29 | 13 | 105 |
| 95 | .29 | 1.71 | .86 | .68 | 194 | 20 | 12 | 30 | 12 | 98 |
| 95 | .33 | 1.93 | .70 | .67 | 213 | 18 | 12 | 44 | 13 | 93 |
| 90 | .29 | 1.78 | .89 | .59 | 232 | 21 | 11 | 44 | 14 | 88 |
| LSD, 5 percent* | .01 | .10 | .03 | .03 | 11 | ns | ns | 4 | 1 | |
| Sufficient quantity | .25 | 1.71 | .21 | .21 | 21 | 20 | 6 | 21 | 4 | |

[1]Mean over all hybrids and starter treatments for planting date.
[2]Mean over all hybrids and planting dates for starter.
[3]Mean over all planting dates and starter for individual hybrids.
*When means are different by an amount equal to or greater than the LSD they are statistically different at the 95 percent level of confidence.
ns = not statistically different.

**Table 15. The effect of planting date, starter fertilizer, and corn hybrids on nutrient concentration of corn at two stages of growth (whole plant at 12-inch corn height and ear leaf at tasseling time): Morris, 1975.**

| | percent | | | | ppm | | | | | Corn yield |
|---|---|---|---|---|---|---|---|---|---|---|
| | P | K | Ca | Mg | Fe | Zn | Cu | Mn | B | bu/a |
| | percent | | | | ppm | | | | | Corn yield |
| | P | K | Ca | Mg | Fe | Zn | Cu | Mn | B | bu/a |
| | Whole plant, 12-inch height | | | | | | | | | |
| Planting date[1] | | | | | | | | | | |
| May 8 | .44 | 3.56 | 1.28 | .66 | 2077 | 48 | 7 | 159 | 8 | 135 |
| May 23 | .42 | 4.55 | .54 | .51 | 599 | 47 | 8 | 109 | 7 | 132 |
| June 10 | .48 | 4.50 | .47 | .57 | 390 | 58 | 9 | 119 | 8 | 113 |
| LSD 5 percent* | .03 | .74 | .53 | ns | 308 | 4 | ns | 29 | ns | |
| Starter[2] | | | | | | | | | | |
| None | .46 | 4.0 | .76 | .59 | 1035 | 53 | 8 | 134 | 8 | 126 |
| 10+40+20 | .44 | 4.31 | .77 | .57 | 1009 | 49 | 8 | 125 | 8 | 128 |
| LSD 5 percent* | .01 | .10 | ns | ns | ns | 3 | ns | 8 | ns | |
| Hybrid relative maturity[3] | | | | | | | | | | |
| 105 | .47 | 4.50 | .72 | .57 | 830 | 53 | 8 | 141 | 8 | 132 |
| 105 | .45 | 4.38 | .76 | .56 | 1018 | 51 | 8 | 143 | 8 | 125 |
| 100 | .43 | 4.28 | .81 | .52 | 1017 | 52 | 7 | 112 | 7 | 130 |
| 95 | .46 | 4.05 | .83 | .66 | 1098 | 50 | 8 | 123 | 8 | 129 |
| 95 | .46 | 4.20 | .70 | .64 | 1071 | 48 | 8 | 133 | 7 | 133 |
| 90 | .46 | 3.90 | .82 | .59 | 1141 | 51 | 9 | 142 | 8 | 118 |
| 85 | .44 | 4.19 | .70 | .52 | 1036 | 52 | 8 | 120 | 8 | 135 |
| 80 | .46 | 4.18 | .78 | .60 | 972 | 51 | 9 | 128 | 8 | 115 |
| 80 | .42 | 4.14 | .78 | .57 | 1016 | 52 | 6 | 120 | 7 | 124 |
| LSD 5 percent* | .02 | .29 | .12 | .04 | 195 | ns | 1 | 9 | 1 | |
| Sufficient quantity | .40 | 3.0 | .30 | .30 | 50 | 20 | 7 | 50 | 7 | |
| | Ear leaf at tasseling | | | | | | | | | |
| Planting date[1] | | | | | | | | | | |
| May 8 | .26 | 2.04 | .47 | .52 | 203 | 24 | 9 | 97 | 8 | 135 |
| May 23 | .29 | 1.94 | .50 | .56 | 187 | 29 | 9 | 105 | 8 | 132 |
| June 10 | .29 | 1.83 | .48 | .68 | 185 | 33 | 11 | 103 | 10 | 113 |
| LSD 5 percent* | .02 | ns | ns | ns | ns | 5 | ns | ns | ns | |
| Starter[2] | | | | | | | | | | |
| None | .28 | 1.89 | .48 | .60 | 192 | 29 | 10 | 104 | 8 | 126 |
| 10+40+20 | .28 | 1.99 | .48 | .58 | 192 | 28 | 10 | 100 | 8 | 128 |
| LSD 5 percent* | ns | .09 | ns | .19 | ns | ns | ns | 3 | ns | |
| Hybrid relative maturity[3] | | | | | | | | | | |
| 105 | .26 | 1.86 | .51 | .64 | 166 | 29 | 9 | 88 | 9 | 132 |
| 105 | .26 | 1.95 | .44 | .58 | 168 | 23 | 10 | 86 | 9 | 125 |
| 100 | .25 | 1.98 | .42 | .43 | 168 | 32 | 11 | 78 | 8 | 130 |
| 95 | .27 | 1.79 | .46 | .64 | 165 | 26 | 9 | 73 | 7 | 129 |
| 95 | .30 | 1.96 | .41 | .62 | 201 | 24 | 9 | 107 | 8 | 133 |
| 90 | .28 | 1.72 | .55 | .64 | 190 | 32 | 10 | 126 | 9 | 118 |
| 85 | .30 | 2.31 | .42 | .50 | 209 | 29 | 9 | 120 | 8 | 135 |
| 80 | .30 | 1.76 | .58 | .65 | 213 | 34 | 11 | 114 | 10 | 115 |
| 80 | .32 | 2.14 | .56 | .59 | 244 | 27 | 10 | 127 | 8 | 124 |
| LSD 5 percent* | .01 | .13 | .04 | .05 | 12 | 2 | 1 | 10 | 1 | |
| Sufficient quantity | .25 | 1.71 | .21 | .21 | 21 | 20 | 6 | 21 | 4 | |

[1]Mean over all hybrids and starter treatments for planting date.
[2]Mean over all hybrids and planting dates for starter.
[3]Mean over all planting dates and starter for individual hybrids.
*When means are different by an amount equal to or greater than the LSD they are statistically different at the 95 percent level of confidence.
ns = not statistically different.

**Table 16. The effect of planting date, starter fertilizer, and corn hybrids on nutrient concentration of corn at two stages of growth (whole plant at 12-inch corn height and ear leaf at tasseling time): Lamberton, 1975.**

| | percent | | | | ppm | | | | | Corn yield |
|---|---|---|---|---|---|---|---|---|---|---|
| | P | K | Ca | Mg | Fe | Zn | Cu | Mn | B | bu/a |

| | percent | | | | ppm | | | | | Corn yield |
|---|---|---|---|---|---|---|---|---|---|---|
| | P | K | Ca | Mg | Fe | Zn | Cu | Mn | B | bu/a |
| | Whole plant, 12-inch height | | | | | | | | | |
| Planting date[1] | | | | | | | | | | |
| May 2 | .46 | 3.89 | .64 | .54 | 854 | 44 | 9 | 75 | 8 | 92 |
| May 13 | .42 | 3.71 | .61 | .46 | 1386 | 36 | 8 | 87 | 6 | 83 |
| May 27 | .40 | 4.52 | .48 | .42 | 251 | 46 | 7 | 67 | 9 | 80 |
| LSD 5 percent* | .05 | ns | .04 | .08 | ns | 2 | 1 | ns | ns | |
| Starter[2] | | | | | | | | | | |
| None | .43 | 4.09 | .58 | .48 | 839 | 43 | 8 | 78 | 8 | 85 |
| 12+40+20 | .43 | 3.99 | .58 | .47 | 822 | 40 | 8 | 74 | 9 | 85 |
| LSD 5 percent* | ns | ns | ns | ns | ns | 3 | ns | ns | 1 | |
| Hybrid relative maturity[3] | | | | | | | | | | |
| 115 | .42 | 4.02 | .54 | .43 | 835 | 43 | 9 | 76 | 8 | 88 |
| 110 | .40 | 3.79 | .59 | .45 | 857 | 40 | 8 | 68 | 8 | 86 |
| 110 | .42 | 3.90 | .59 | .45 | 861 | 43 | 8 | 73 | 8 | 89 |
| 105 | .44 | 4.00 | .62 | .51 | 825 | 42 | 8 | 76 | 8 | 92 |
| 105 | .43 | 4.13 | .59 | .50 | 839 | 45 | 8 | 84 | 8 | 83 |
| 100 | .44 | 4.16 | .54 | .51 | 838 | 44 | 8 | 77 | 8 | 98 |
| 95 | .45 | 4.27 | .58 | .51 | 762 | 42 | 8 | 76 | 7 | 83 |
| 95 | .43 | 4.08 | .59 | .49 | 825 | 40 | 8 | 78 | 8 | 82 |
| 90 | .43 | 3.99 | .55 | .45 | 833 | 39 | 8 | 80 | 8 | 65 |
| LSD 5 percent* | .02 | .26 | .04 | .03 | ns | ns | ns | 7 | ns | |
| Sufficient quantity | .40 | .30 | .30 | .30 | 50 | 20 | 7 | 50 | 7 | |
| | Ear leaf at tasseling | | | | | | | | | |
| Planting date[1] | | | | | | | | | | |
| April 25 | .22 | 1.85 | .77 | .56 | 255 | 22 | 8 | 53 | 16 | 92 |
| May 10 | .21 | 1.87 | .73 | .52 | 253 | 23 | 8 | 58 | 13 | 83 |
| May 25 | .20 | 1.87 | .77 | .56 | 239 | 31 | 8 | 55 | 18 | 80 |
| LSD 5 percent* | ns | ns | ns | ns | ns | 1 | ns | ns | 2 | |
| Starter[2] | | | | | | | | | | |
| None | .21 | 1.88 | .75 | .54 | 25 | 26 | 7 | 55 | 16 | 85 |
| 12+40+20 | .21 | 1.85 | .77 | .55 | 246 | 25 | 8 | 56 | 16 | 85 |
| LSD 5 percent* | ns | ns | .01 | ns | ns | ns | ns | ns | ns | |
| Hybrid relative maturity[3] | | | | | | | | | | |
| 115 | .20 | 1.97 | .71 | .56 | 251 | 30 | 7 | 57 | 16 | 88 |
| 110 | .21 | 1.96 | .78 | .56 | 246 | 21 | 7 | 48 | 16 | 86 |
| 110 | .20 | 1.93 | .74 | .57 | 264 | 29 | 8 | 71 | 17 | 89 |
| 105 | .21 | 2.09 | .75 | .53 | 224 | 26 | 7 | 51 | 14 | 92 |
| 105 | .21 | 2.00 | .72 | .48 | 241 | 20 | 8 | 52 | 16 | 83 |
| 100 | .20 | 1.71 | .76 | .47 | 237 | 31 | 8 | 47 | 15 | 98 |
| 95 | .22 | 1.68 | .82 | .62 | 231 | 27 | 8 | 51 | 14 | 83 |
| 95 | .24 | 1.75 | .70 | .57 | 273 | 21 | 8 | 59 | 16 | 82 |
| 90 | .21 | 1.69 | .83 | .57 | 274 | 24 | 7 | 65 | 17 | 65 |
| LSD 5 percent* | .01 | .11 | .05 | .05 | 20 | 2 | 1 | 5 | 2 | |
| Sufficient quantity | .25 | 1.71 | .21 | .21 | 21 | 20 | 6 | 21 | 4 | |

[1]Mean over all hybrids and starter treatments for planting date.
[2]Mean over all hybrids and planting dates for starter.
[3]Mean over all planting dates and starter for individual hybrids.
*When means are different by an amount equal to or greater than the LSD they are statistically different at the 95 percent level of confidence.
ns = not statistically different.

**Table 17. The effect of planting date, starter fertilizer, and corn hybrids on nutrient concentration of corn at two stages of growth (whole plant at 12-inch corn height and ear leaf at tasseling time): Waseca, 1975.**

| | percent | | | | ppm | | | | | Corn yield |
|---|---|---|---|---|---|---|---|---|---|---|
| | P | K | Ca | Mg | Fe | Zn | Cu | Mn | B | bu/a |
| | percent | | | | ppm | | | | | Corn yield |
| | P | K | Ca | Mg | Fe | Zn | Cu | Mn | B | bu/a |
| | Whole plant, 12-inch height | | | | | | | | | |
| Planting date[1] | | | | | | | | | | |
| May 10 | .50 | 3.26 | .78 | .45 | 1001 | 40 | 7 | 92 | 13 | 135 |
| May 25 | .44 | 3.54 | .68 | .48 | 861 | 33 | 8 | 93 | 10 | 112 |
| LSD 5 percent* | .04 | ns | ns | ns | ns | ns | ns | ns | 1 | |
| Starter[2] | | | | | | | | | | |
| None | .44 | 3.06 | .77 | .50 | 906 | 38 | 7 | 91 | 12 | 123 |
| 9-23-30, 140 lb/a | .48 | 3.74 | .70 | .42 | 957 | 32 | 7 | 94 | 11 | 125 |
| LSD 5 percent* | .03 | .08 | .03 | .02 | ns | 3 | ns | 3 | 1 | |
| Hybrid relative maturity[3] | | | | | | | | | | |
| 115 | .46 | 3.30 | .72 | .45 | 894 | 39 | 7 | 84 | 13 | 120 |
| 110 | .47 | 3.30 | .76 | .48 | 923 | 36 | 7 | 97 | 11 | 130 |
| 110 | .44 | 3.28 | .69 | .46 | 1003 | 34 | 8 | 92 | 12 | 137 |
| 105 | .50 | 3.61 | .80 | .45 | 906 | 34 | 7 | 97 | 11 | 115 |
| 105 | .45 | 3.63 | .73 | .45 | 960 | 37 | 7 | 98 | 11 | 118 |
| 100 | .46 | 3.33 | .72 | .42 | 918 | 33 | 7 | 82 | 12 | 133 |
| 95 | .45 | 3.34 | .78 | .52 | 789 | 34 | 7 | 86 | 11 | 122 |
| 95 | .51 | 3.48 | .66 | .51 | 875 | 38 | 8 | 94 | 12 | 126 |
| 90 | .45 | 3.32 | .73 | .44 | 1113 | 31 | 7 | 103 | 12 | 110 |
| LSD 5 percent* | .04 | ns | .08 | .04 | 20 | ns | ns | 14 | ns | |
| Sufficient quantity | .40 | 3.0 | .30 | .30 | 50 | 20 | 7 | 50 | 7 | |
| | Ear leaf at tasseling | | | | | | | | | |
| Planting date[1] | | | | | | | | | | |
| May 10 | .25 | 1.69 | 1.00 | .59 | 279 | 22 | 8 | 68 | 16 | 135 |
| May 25 | .23 | 1.51 | 1.01 | .68 | 219 | 24 | 8 | 63 | 16 | 112 |
| LSD 5 percent* | .01 | ns | ns | ns | ns | ns | ns | ns | ns | |
| No starter[2] | .24 | 1.54 | 1.01 | .65 | 252 | 24 | 8 | 67 | 16 | 123 |
| Starter | .24 | 1.66 | .99 | .62 | 246 | 21 | 8 | 63 | 16 | 125 |
| LSD 5 percent* | ns | .03 | ns | .02 | ns | 1 | ns | 2 | ns | |
| Hybrid relative maturity[3] | | | | | | | | | | |
| 115 | .23 | 1.35 | .95 | .70 | 228 | 27 | 8 | 61 | 15 | 120 |
| 110 | .24 | 1.79 | .98 | .61 | 258 | 21 | 7 | 62 | 17 | 130 |
| 110 | .23 | 1.45 | .98 | .69 | 251 | 21 | 9 | 77 | 17 | 137 |
| 105 | .25 | 1.76 | 1.03 | .61 | 216 | 25 | 8 | 63 | 14 | 115 |
| 105 | .24 | 1.91 | .96 | .54 | 246 | 21 | 8 | 58 | 16 | 118 |
| 100 | .22 | 1.72 | .98 | .54 | 255 | 25 | 8 | 54 | 16 | 133 |
| 95 | .25 | 1.36 | 1.09 | .74 | 273 | 22 | 8 | 59 | 15 | 122 |
| 95 | .26 | 1.58 | .94 | .64 | 279 | 21 | 8 | 73 | 16 | 126 |
| 90 | .25 | 1.50 | 1.10 | .63 | 284 | 23 | 8 | 81 | 18 | 110 |
| LSD 5 percent* | .02 | .29 | .10 | .09 | 34 | ns | ns | 13 | 2 | |
| Sufficient quantity | .25 | 1.71 | .21 | .21 | 21 | 20 | 6 | 21 | 4 | |

[1]Mean over all hybrids and starter treatments for planting date.
[2]Mean over all hybrids and planting dates for starter.
[3]Mean over all planting dates and starter for individual hybrids.
*When means are different by an amount equal to or greater than the LSD they are statistically different at the 95 percent level of confidence.
ns = not statistically different.