grower could inject 1 quart of fluid through three injection sites into a mature pear tree in less than 1 minute for a fall treatment. (Injection takes longer in early morning or at night than it does in the afternoon and varies according to climatic and tree conditions. The machine and how it is used are described in detail in the December 1976 issue of this magazine.)

During 1975, the first year that pressure injection was available to growers, some 140,000 pear trees were treated – half by transfusion bottles and half by pressure injection. The methods were equally effective in pear decline control. During the 1976 season, between 140,000 and 200,000 trees were treated.

Following their initial transfusion or pressure injection, decline-infected trees must be treated the following year or two. If trees improve in vigor following treatment and regain nearly normal growth, the yearly treatment can be withheld until trees again show partial decline. Then, only those trees need be treated.

Generally, according to Beutel, growers report that they are getting double the fruit production they had before beginning their tetracycline treatments. Their production per tree, however, is only around 70 to 80 percent of what they obtained before pear decline initially infected their orchards.

In addition to playing an important role in the pear decline control program, antibiotics and the pressure-injector machine show potential for helping growers of other orchard crops solve some of their disease problems. Bactericides and fungicides have been injected, with favorable results, into cherry, peach, apple, almond, walnut, and olive trees. Other potential uses of pressure injection include treatment of minor nutrient deficiencies and control of sucking insects. Thus, as is often the case, research which has led to the resolution of one problem may well lead to the solutions of others.

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Sunlight and temperature effects on corn growth and yield

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Grain yields of corn in the United States differ considerably between one area and another even when soil fertility and moisture supply are considered near-optimal. Reasons for such variation are difficult to evaluate because direct comparisons are confused by differences in sunlight amount, temperature, photoperiod, and variety.

To study these differences in relation to the adaptability of corn varieties, experiments were conducted in 1969 and 1970 at three locations that differed widely in sunlight and temperature regimes but only slightly in other climatic characteristics. Fertilizer and water were provided in amounts considered adequate for maximum grain yields at all locations.

The locations chosen were Davis and Greenfield, California, and Lexington, Kentucky. Davis, in the lower Sacramento Valley, has a hot, dry summer climate with large amounts of sunlight, but modified to some degree by cooler air from the Pacific Ocean. Greenfield, in the Salinas Valley, California's largest coastal valley, has less sunlight and a climate strongly modified by cooling onshore winds. Lexington has a humid continental climate reasonably representative of the southern edge of the corn belt, and the least sunlight along with the highest mean temperature in the growing season.

Five varieties with a wide range of maturity were planted April 15 and May 15 in each of the two years. The varieties were: Renk NR1, DeKalb XL 45, P.A.G. SX 29, DeKalb XL 85 (1969 only), Pioneer 3306, and TX508 x K64 (1970 only) in order of maturing. The first matured extremely early; the second was intermediate; and the last four matured later and were quite similar in maturity.

Plant populations were 8,000, 19,000, and 30,000 plants per acre in 1969; and 10,000, 19,000, and 29,000 (also 44,000 at Davis and Greenfield) in 1970. No significant insect or disease problems were experienced aside from southern leaf blight, which affected four of the five varieties at Lexington in 1970. Irrigation water was supplied by overhead sprinklers at Davis and Lexington, and by furrow at Greenfield.

Plant height and development rate

There was a striking difference in plant height at the three locations in 1970. Average plant heights for the two dates of planting are 112 inches at Davis, 83 inches at Greenfield, and 97 inches at Lexington. There was also a slight increase in height at each location for each increase in plant population.

Such differences must be accounted for either by differences in internode length or numbers or both. The number of nodes above the soil level for all varieties averaged 25 percent more at Davis and 5 percent more at Greenfield than at Lexington. Since the plants were shorter but with more nodes at Greenfield than at Lexington, both node number and internode length were involved in determining plant height. Plants were shortest at the coolest location (Greenfield) and with the earlier, and cooler, planting date.

Differences in development rate for time from planting to half-silk (when 50 percent of plants have silked) varied by location and by planting date within a location. Table 1 shows the number of days from planting to half-silk for each planting date at each location. Development was slowest at Greenfield for each planting date.

Grain yields

Table 2 shows grain yields averaged over varieties for planting dates and the three plant populations used at all locations in their respective years. Grain yields were highest at Davis in almost every comparison. Yields at Greenfield were nearly the same as at Lexington. Differences for years and for planting dates within years were generally small. Yield increases due to early planting were significant at Davis but not at Greenfield. Differences in yield due to planting date are not meaningful at Lexington in 1970 because of leaf blight at that location.

Yields for the highest plant population (44,000 plants per acre, used only at the two California locations in 1970) were very similar to those obtained from the next-highest population and are not included in table 2. With this exception, yields increased significantly in response to increasing plant population.

Yields were positively associated with the accumulation of sunlight, with Davis showing the greatest accumulations and the highest yields. This relationship is expected because the intensity and duration of sunlight influences the amount of photosynthesis per plant.

Temperature affects photosynthesis per plant through the direct effect of leaf temperature on rate of photosynthesis per unit of leaf surface. Although leaf temperatures were not measured in this experiment, an assumption that they approximate air temperatures should not introduce enough error to invalidate conclusions. Temperatures at Davis should have favored efficient photosynthesis for most of each day. At Greenfield consistently strong onshore winds tend to keep leaf temperatures close to air temperatures and generally cooler than optimum. At Lexington the range of temperatures found during the growing season indicates that daytime temperatures were generally favorable for efficient photosynthesis.

Others have shown that temperature influences photosynthesis per plant by its effect on development rate, which in turn affects the number of days that corn plants are exposed to sunlight. Here the earlier planting dates resulted in a slower rate of development and a greater exposure to sunlight (table 1). At Davis the April 15 planting date gave the highest yield in each year, whereas at Lexington and Greenfield no relationship could be established between yield and planting date (and thus total sunlight).

Ear characteristics

Kernel weight decreased 5 percent at Davis and Lexington and 11 percent at Greenfield when plant population was increased from 8,000 to 30,000 plants per acre (1969 data). Since the average kernel weights at each location for a given population were nearly the same, the differences in grain yield among locations for any population and planting date could result only from the number of ears per plant or the number of kernels per ear.

Many plants at the lowest population (8,000 plants per acre) had more than one ear per plant, and grain yield was closely related to the number of ears per plant at both Greenfield and Davis. With 30,000 plants per acre at Davis and Greenfield, all varieties were essentially single-eared, and stands were nearly perfect. Thus the differences in grain yield were due chiefly to differences in number of kernels per ear.

TABLE 1. Development of Five Corn Varieties from Planting to Half-Silk Over All Rates of Planting in 1969

Location	Planting date	Days*	Sunlight total	Degree days
			Langleys†	
Davis, Ca	April 15	74	50,300	1,270
	May 15	63	44,500	1,245
Greenfield, Ca	April 15	82	44,100‡	1,185
	May 15	71	38,800‡	1,200
Lexington, Kentucky	April 15	79	39,600	1,325
	May 15	59	29,500	1,285

*Average number of days.
†Langley = cal/cm^2.
‡Estimated values.

TABLE 2. Average Grain Yield of Five Corn Varieties at Three Locations in 1969 and 1970

Planting date	1969 Planting rate	1969 Average grain yield* Davis	Greenfield	Lexington	1970 Planting rate	1970 Average grain yield* Davis	Greenfield	Lexington
	plants/a		*lb/acre*		*plants/a*		*lb/acre*	
April 15	8,000	6,600	5,600	4,500	10,000	6,800	5,800	5,400
May 15		5,200	6,200	5,100		5,500	5,000	4,500†
April 15	19,000	9,500	7,700	7,800	19,000	9,800	7,400	7,700
May 15		9,100	8,100	7,800		8,700	6,600	5,800†
April 15	30,000	12,000	9,000	8,200	29,000	10,600	8,100	8,800
May 15		11,000	9,500	8,400		9,800	7,400	6,200†
Sunlight‡ (Langley)		117,000	94,000	85,000		119,000	101,000	85,000

*15.5% moisture. LSD 5%. In 1969: April 15 = 600, May 15 = 800. In 1970: April 15 = 600, May 15 = 700
†Yield reduced by southern leaf blight at Lexington.
‡Total for April through September. Langley = cal/cm^2.

Summary

Five hybrid varieties of maize (*Zea mays* L.) were planted at three rates and two dates for two years at Lexington, Kentucky; Greenfield, California; and Davis, California; locations with nearly the same latitude and elevation but having climates differing widely in sunlight and average daily temperature.

Grain yields were highest at Davis, which had the highest sunlight levels, highest daylight temperatures, and second-lowest night temperatures. Grain yields were lowest at Lexington, which had the lowest sunlight levels, moderately high daylight temperatures, and the highest night temperatures. Grain yields at each location were positively correlated with planting rate.

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