2001

YOLO/SOLANO/SACRAMENTO

FIELD CORN PRODUCTION

TRIAL RESULTS

Cooperative Extension
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ACKNOWLEDGMENT

Appreciation is expressed to all of the growers and seedsmen for their excellent cooperation in conducting the trials reported in this book.

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Cooperative Extension Work in Agriculture and Home Economics. U.S. Department of Agriculture, University of California, and Yolo County Cooperating.

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INTRODUCTION

The acreage of local corn increased in 2000 over 1999 in spite of very low prices. This was mainly due to the lack of acreage of profitable crops. A record corn crop is predicted for the United States. Yields varied in a somewhat normal pattern with some growers reporting below average yields and others above their average yields. Some fields had above average infections of fusarium ear rot.

There were a few corn fields planted with reduced tillage and there will be increased acreage and interest in reduced tillage in coming years. Reduced tillage is being looked at as a method to reduce costs of corn production.

Corn Acreage

Year	Yolo County	Solano County	Sacramento County	Total
2000	28,125	22,713	44,000	94,838
1999	13,513	15,600	28,000	57,113
1998	22,386	21,672	37,000	81,058
1997	41,968	23,905	32,000	97,873
1996	35,466	28,083	36,800	100,349
1995	24,536	20,534	31,800	76,870
1994	21,650	18,101	28,700	68,451
1993	16,380	15,149	28,500	60,029
1992	21,200	15,730	25,700	62,630
1991	12,900	27,100	25,000	65,000
1990	15,000	29,500	29,200	73,700

This report contains cultural information and the results of field corn and grain sorghum trials conducted in Yolo and Sacramento counties in 2000.

Natural variation in fertility, moisture supply, and many other factors may account for part of the differences in yield observed between varieties or treatments in a trial. Because of this variation, small differences in yield may have little meaning. The yield differences in pounds per acre between varieties or treatments required for significance at the 5% level is given for all trials where such differences were observed. Duncan's Multiple Range Test was used for most of the trials. Treatments or varieties connected by the same letter are not considered significantly different at the 5% level of probability. The coefficient of variability (C.V.) given for a trial is a measure of the relative amount of unexplained variation present at a test location. The smaller the coefficient of variability, the less unexplained variation. A C.V. below 10% is considered very good.

The yield and performance of a variety in any one year or from a very limited number of trials may not be an accurate indication of its performance under another set of conditions. We would not recommend changing completely to a new variety with performance in a limited number of trials the only basis for selection.

Description of methods used to obtain data reported in this report:

Tasseling Data:	When 90% to 100% of the fertile plants are beginning to shed pollen.
Ear Height:	Distance from the ground to middle of ear shank.
Bushel Weight:	Determined on air dry samples.
Moisture Content:	Burrow Moisture Meter.
Harvest Population:	Based on count of consecutive plants in 1/200 of an acre.

FIELD CORN PRODUCTION

Planting Date:

The optimum planting date in this area is usually from mid March through April. With this planting date, most of the pollination will occur before the extremely hot temperatures hit, which usually occur from the middle of July to early August. Also, with most March and early April plantings there should be sufficient rainfall to insure that the permanent secondary root system (which develops above the seed) will be established. This root system forms about 1 inch below the soil level and must have moisture in order for the roots to develop. Good yields can be obtained by planting after April, but the risk from adverse temperatures and low humidities during pollination are increased.

Soil temperature should be at least 55°F when planting. The minimum soil temperature at which corn will germinate is 45-50°F. The optimum range is 80-90°F. Corn planting is generally 10 days to 2 weeks after the average date of the last killing frost. Corn is able to recover from light freezes that occur before the plants are 6 inches tall. Varieties now in use, generally reach maturity in 130 to 175 days.

Planting Schedule:

In order to begin harvesting as early as possible and to spread the harvest period, a grower may want to plant an early maturing variety first followed by medium and late varieties. Early harvested corn often brings a premium price (late August to early September). After the optimum planting time has passed, then again plant the early maturing varieties in order to complete harvesting before adverse weather conditions occur. In general, the early maturing varieties show more seedling vigor with early plantings under cool soil temperatures, than the later varieties. Seedling vigor differences are minimized as soil temperatures increase.

Planting:

Planting is an extremely important operation in corn production. It is important that most of the corn seedlings emerge uniformly. In order to accomplish this, it is desirable to begin preparing a seed bed for planting in the fall or early in the spring. For corn, the most desirable type of seed bed is a fine, moist seed bed. Early formed beds are preferred for early plantings because the soil in the beds warms and dries faster in the spring and compaction in the seed row is eliminated compared to flat plantings.

The most extensively used method and most satisfactory, is to plant into moisture either from natural rainfall or from a pre-irrigation. Irrigating up is quite satisfactory with later planting when soil temperatures are warmer. However, with March and early April plantings, irrigating up may cool the soil too much for germination.

Planting Depth:

Ideal planting depth is 2 - 2-1/2 inches. It is desirable to have approximately 1 inch of moist soil above the seed. If you have a fine, moist seed bed, 2 inches should be proper planting depth. Three inches are considered about as deep as we would like to see corn planted. If you plant quite deep early when the soil is cold, beating rains could cause a severe crust and the deep planted seed may not have enough energy to push through the crust and make a good stand. Crusts should always be broken if possible before the corn shoot contacts it.

Type of Planters:

We do not like the old disc planter used for sugar beets except when used for planting in dry soil and irrigating up. It is difficult to uniformly place the seed into moisture with disc planters. We much prefer the corn shoe or the long shoe type planters. The newer double disc planters with press wheels designed for corn are satisfactory.

The Planter:

One of the most important parts of your planter that should be checked is the little knocker wheel. It is spring loaded and has a little round wheel that runs on the corn plate and pushes the kernels out of the planter. It is important that this wheel is not broken or badly worn and that the spring has good tension. If it is not working and if a slightly large seed comes into the plate, it may stick in the plate and cause a skip to occur while the kernel is stuck in the plate.

Corn Shoe Runners:

When shoe runners become flat on the bottom and do not place the seed in a good moist grove, can result in poor germination. Replace shoe bottoms when badly worn.

The Drive Wheel - (which runs the planter):

Older planters have a narrow drive wheel and newer model planters have a wide drive wheel. The wider drive wheel has less tendency to slip and gives a more uniform planting. The narrow drive wheel can give uniform planting, but it requires a smoother seed bed, one that is not cloddy. The narrow drive wheel tends to slip in cloddy conditions because it does not have the traction of the wider wheel. A new, wide wheel can be put on some of the older planters. Growers should consider this, particularly in situations where they are planting in dry, cloddy conditions, and the drive wheel may have a tendency to slip.

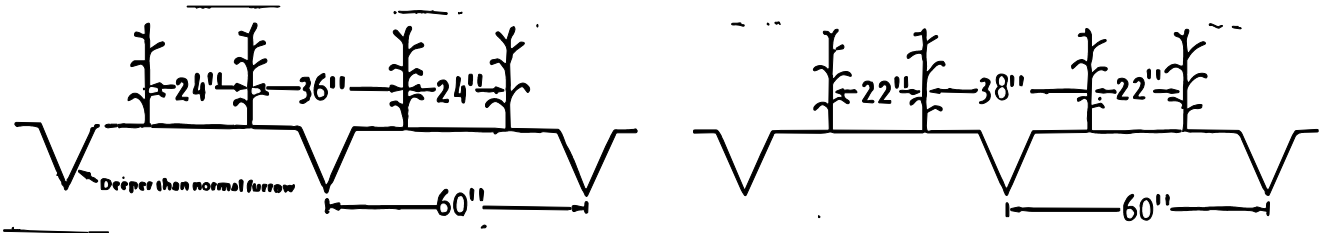
New Planters:

The new air planters used to plant the Slater variety trials since 1989 and the 2000 Mello trial have given very good populations for a wide range of seed sizes.

Bed Planting:

There is increasing evidence that the growth and activity of the plant-root system is a limiting factor in maximizing crop yields. One of the most recent new developments in cultural practices for corn grown on poorly-drained saline and clay soils is the use of high 60 inch beds. Two rows for corn are planted on each bed. However, they must be planted closer than the normal 30 inches in order to make a deeper than normal furrow to produce the desired drainage effect. Examples of spacing that have been used include 22-38, 24-36, 26-34, 28-32, and 30-30. This bedding technique will partly reduce the injury from drowning and scalding that normally occurs under poorly-drained conditions. The benefits from bed planting have also been dramatic in other crops such as wheat and alfalfa.

Schematic Examples of Beds Used on Poorly-Drained Soils



Growth of the Plant:

At germination, the primary root system is the first structure to emerge from the seed. Typically, the primary root system consists of the radical and 3 seminal roots. Shortly after the primary root has emerged, the first internode elongates and pushes the coleoptile towards the soil surface. The length of the first internode depends upon the depth of the planting. The first internode increases in length until the node from which the coleoptile grows is within about 2 inches of the soil surface. This is one reason that corn can be planted deeper than small grains and still emerge. When the tip of the coleoptile is past the ground level, it splits and the first of the foliage leaves emerges through the split.

The main root system of the corn plant develops from the nodes above the seed near the ground level. They form from about an inch below the soil surface no matter how deep the seed is planted. Moisture must be available in this area in order for these roots to begin growing. Corn roots spread to about 3.5 feet and can penetrate to 10 feet or more in deep, permeable soil.

Plant Population:

Most varieties are planted at 30,000 to 36,000 plants per acre.

Plant population is a key factor influencing corn yields. With the varieties now in use, it is important that they are planted at the proper populations for maximum yield and to avoid lodging. Consult your seedsman for specific seeding rates. Most varieties usually require about 18 pounds per acre.

It is important that corn plants are spaced evenly down the rows. Corn has less ability to compensate for gaps in the stand and multiple dropped seeds than many other crops. A study in Kansas showed yield increases of from 200 to 1,200 pounds per acre where the plants were perfectly spaced, versus the planting that was obtained with commercial planters. Therefore, it is important that the planters are operating properly and not too fast. Air planters can operate at a faster speed than ground driven plate flex planters can.

Pollination:

Corn is a naturally cross-pollinated crop. The pollen is distributed by wind and gravity from the tassel to the silks of the ears. The silks emerge in succession from the base to the tip in 2 to 5 days and are receptive to pollen whenever they emerge and remain receptive up to 2 weeks. The ears pollinate from the base to the tip. Thus, pollination occurs over several days. Each tassel sheds pollen for several days. A corn field will usually have plants shedding pollen over a 2-week period, thus assuring good pollination under most conditions. Many corn varieties now in use have some sterile tassels.

With corn, it is important that all of the plants emerge at the same time, so there is a good pollen supply available for all plants. For plants that emerge late, it is very likely there will be insufficient pollen for pollination.

Corn plants are quite susceptible to injury from high temperatures and low humidities at the tasseling stage. Pollen may not be produced or may dry up before pollination takes place, resulting in poor kernel set.

A distortion of silk growth (called jamming) is caused by high temperatures. In jamming, the silks grow first upward, then downward and sometimes up and down again within the husks, instead of growing straight up and emerging from the husk tip. The folded silks may finally emerge from the husks, although usually too late for pollination.

Rotation*:*

Corn is usually grown in a rotation, but it does follow itself better than most crops. A buildup of diseases has been noted in some fields planted to continuous corn. Two of the diseases have been fusarium stalk rot and charcoal stalk rot.

FERTILIZATION

Nitrogen:

A general range would be from 200 to 275 pounds per acre, on mineral sois, depending on plant population and previous crop.

Many growers prefer not to apply preplant nitrogen prior to planting because this operation can cause the seed bed to dry out and not have good moisture for germination. In fields with low nitrogen reserves it may be desirable to apply a portion of the nitrogen preplant. Do not inject ammonia directly below where the seed row will be planted. Corn only needs 2% of its nitrogen during the first month. Most of the nitrogen is absorbed 6 to 12 weeks after planting. A common practice is to use a starter fertilizer at planting and then sidedress. The starter fertilizer should contain about 10 to 15 pounds of nitrogen, with phosphorus and a small amount of zinc.

The nitrogen sidedressing should be applied before the corn is 1-foot tall. The nitrogen in the starter should carry the corn to this stage with no nitrogen deficiency occurring. Stay 8 to 15 inches away from the plants with the sidedressing knives in order to reduce the amount of root pruning and injury from ammonia. The safest source of nitrogen for sidedressing is UN32 solution.

Soil Analysis:

Growers should use soil analysis to evaluate the availability of the fertilizer elements phosphorus, potassium, and zinc.

Phosphorus:

Most growers prefer to apply their phosphorus in a nitrogen phosphorus starter fertilizer to obtain vigorous, early growth. Starter fertilizer is best banded 2 inches below and 2 inches to the side of the seed.

Phosphorus, in a starter fertilizer, is usually applied at 10 to 26 pounds of P per acre (20-60 P_2O_5) with 10 to 20 pounds of nitrogen. Soil tests for phosphorus may not be reliable following several years of rice or on very low pH soils. A yield response is likely with soil levels below 6 ppm phosphorus and not likely with levels above 12 ppm, using the sodium bicarbonate method of analysis.

Potassium:

To date, deficiencies on corn have only been found in a few areas of the state. In the Clarksburg area, the starter should contain potassium. Responses have been obtained with soil values in the range of approximately 70 to 90 ppm potassium, using the ammonium acetate method of analysis or less than 200 ppm by nitric acid extraction. Trials have shown that 20 to 40 pounds per acre of banded potassium (K_2O) would be sufficient for most of the deficiencies encountered. Broadcast applications of potassium have not given good responses when compared to banding.

Zinc:

Zinc deficiency is widespread in Yolo County and may occur anywhere in the state. This deficiency is commonly found as spots of various sizes in a field. Zinc deficiency on corn often shows as a broad band of white or yellow tissue between the mid-rib and edge of the leaf or as a chlorotic striping. It occurs mainly in the lower half of the leaf and may be seen when the young leaf is coming out of the whorl. Severely deficient plants are also stunted and have short internodes. The critical ranges for zinc is 0.4 to 0.6 ppm zinc in the soil, using the DTPA method of analysis.

Zinc fertilization of field corn can be accomplished by the 3 following methods: broadcast and incorporate before planting; with starter fertilizer at planting; and as a foliar spray on small corn seedlings.

1. Broadcast Application: The sources commonly include zinc sulfate, zinc oxide, and zinc nitrate. Suggested rate: 10 to 20 pounds per acre.

2. With Starter Fertilizer: The sources commonly used include zinc sulfate, zinc oxide, and zinc chelates. Suggested rate: 5 pounds per acre for sulfate and oxide forms. A smaller amount may be used with chelates. Some fields in past seasons which used standard starter fertilizers with low zinc content of ½% to ¼% showed zinc deficiency symptoms.

3. As a Foliar Spray: The sources commonly used include zinc sulfate and various zinc chelates. Suggested rate: for zinc sulfate is 3 to 4 pounds per 100 gallons of water with a little spread-sticker at the rate of 20 to 40 gallons per acre, depending on the size of the corn seedlings. The solution should be tested on a few plants before treating the whole field, as excessive concentrations may cause foliage burn within a few hours or overnight. For chelates, follow the directions on the label.

HARVESTING

Corn is considered mature when the moisture content is 34%. Corn usually will not shell satisfactorily if the moisture content is above 25% without excessive kernel damage occurring. Eighteen to 22% moisture is the most desirable range for harvesting. In recent years, most growers have not harvested until the moisture content has reached 15.5% or lower in order to avoid drying costs.

Moisture content should be 14% or lower for safe long-term storage of shelled corn. Under our summer drying conditions, corn will dry on the stalk to 10% moisture content or less.

U. S. STANDARDS FOR CORN

	Minimum Test	Maximum Limits of:		Damaged Kernels	
Grade	Wt. Lbs./Bu	% Moisture	% Broken Corn & Foreign Material	Total	Heat Damage
U.S. No. 1	56.0	14.0	2.0	3.0	0.1
U.S. No. 2	54.0	15.5	3.0	5.0	0.2
U.S. No. 3	52.0	17.5	4.0	7.0	0.5
U.S. No. 4	49.0	20.0	5.0	10.0	1.0
U.S. No. 5	46.0	23.0	7.0	15.0	3.0

U.S. Sample Grade:

U.S. Sample Grade shall be corn which does not meet the requirements for any of the grade from U.S. No. 1 to U. S. No. 5, inclusive; or which contains stones; or which is musty, or sour, or heating; or which has any commercially objectionable foreign odor; or which is otherwise of distinctly low quality.

IRRIGATION

Corn requires the application of 3 to 3.5 acre feet of water. This is usually applied in 5 to 9 irrigations. It is important that moisture be available at the crown of the corn plant when the secondary root system is being established. This will occur from 3 to 4 weeks after planting. The tasseling-to-silking stage is also critical. In this short time, formation of the grain is initiated. If moisture is lacking during this time, pollination is incomplete and poorly-filled ears result. An adequate irrigation at tasseling time is therefore essential. Yield and moisture content of the grain can be affected by lack of available water up to the hard-dough stage of maturity.

When corn is planted into good moisture, no irrigation is usually required for the first 3 weeks. The moisture requirements are met by the roots moving rapidly into moist soil. During this period, about 1 to 1-1/2 inches of moisture are used. Growers should plan ahead

in order to apply first irrigation approximately 30 to 40 days after planting, unless sufficient rainfall has occurred to moisten the area at least to seed depth. Many growers now plant on beds or make small furrows at planting in order to facilitate this early irrigation. This is a very critical time in the development of the ear and moisture stress can cause abortion of the ear. This first irrigation can be delayed in some situations, such as high water table areas or if sufficient rainfall occurs. Sprinkler irrigation is an excellent method to apply this first irrigation. The vegetative period, from emergence to first tassel, lasts for about 8 weeks for an early to medium-early variety. The moisture requirement is about 8 inches.

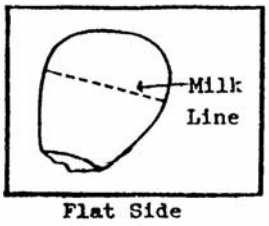
Pollination period covers the next 4 weeks to blister kernel stage. This period also requires about 8 inches of moisture. At Davis, the best irrigation system during this period was 8 weekly irrigations. The grain filling period covers the next 5 weeks to physiological maturity, the moisture requirement is 8 inches. At Davis, this requirement was best met by starting this period with a full moisture profile and no applied irrigations. On shallow soils, subsequent irrigations would be necessary. County field studies indicated that most fields will need an irrigation during the grain filling period.

Irrigation Cut-Off

This is one of the most frequently asked questions by growers. The last irrigation should be timed to provide adequate moisture up to physiological maturity. Corn is mature when it has reached about 35% moisture. Some agronomists use the black layer formation to determine maturity. The newest system being used as a visual indicator of corn kernel maturity is the milk line. The milk line moves from the kernel tip to the kernel base. When the milk line is half-way between the kernel tip and the kernel base, it contains about 40% moisture. The black layer begins to form shortly after dent occurs.

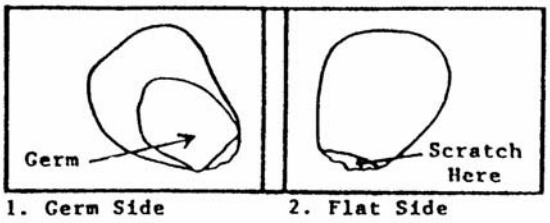
Irrigation - continued

Milk Line Location on Corn Kernel



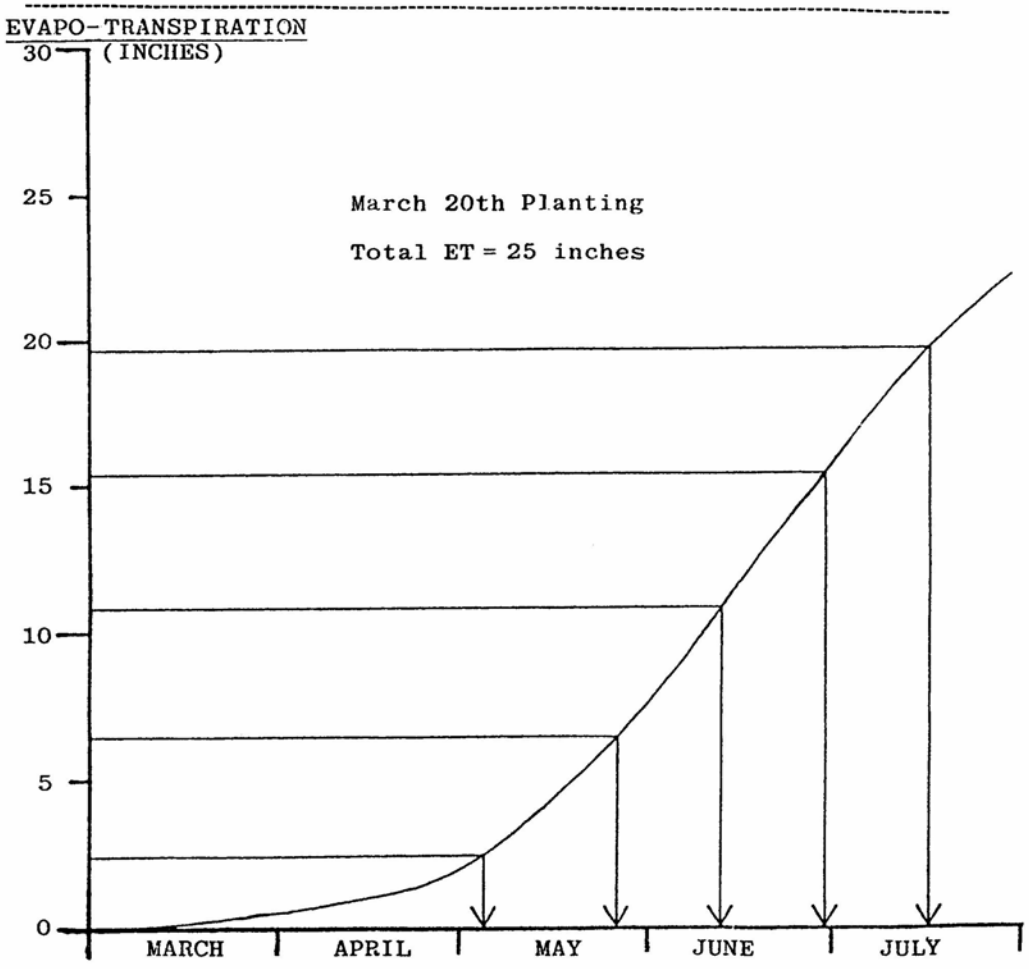
The black layer forms in the tip of each kernel. It forms in the kernels at the tip of the ear first and then spreads over the remainder. To find the black layer, scratch the surface off the base of the kernel on the flat side of the grain opposite the germ side. Scratch gently and a black layer can be seen beneath the surface near the point where the kernel was attached to the cob.

Black Layer Location on Corn Kernel



In summary, an irrigation applied near the beginning of the dent stage usually carries the crop to physiological maturity.

CORN WATER REQUIREMENTS FOR YOLO COUNTY



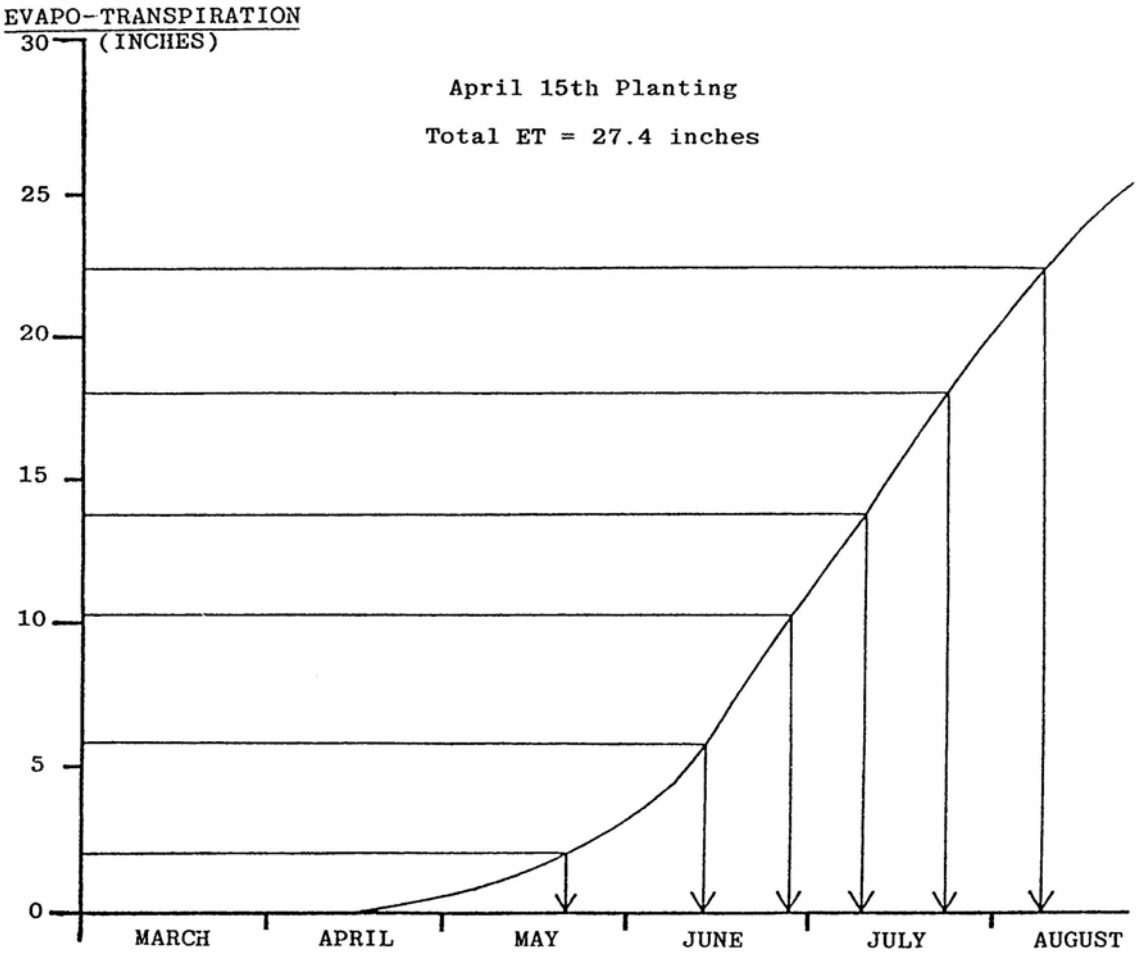
EXPECTED RAINFALL: 2 to 3 inches

GROWING SEASON: 157 days

RECOMMENDED IRRIGATIONS

Number	Date
1	May 10
2	May 31
3	June 17
4	July 4
5	July 21

CORN WATER REQUIREMENTS FOR YOLO COUNTY



EXPECTED RAINFALL: 0 to 2 inches

GROWING SEASON: 150 days

RECOMMENDED IRRIGATIONS

Number	Date
1	May 21
2	June 13
3	June 27
4	July 9
5	July 23
6	August 8

2001 Mello Corn Variety Trial – Tyler Island

Cooperator: Steve Mello
Planting Date: April 17, 2001
Planter: White air planter
Harvest Date: October 9, 2001
Plot Size: 4 rows, 1500 feet long
Soil Type: Egbert muck, Class 1
Seed Drop: 6 inches
Planting Depth: 2 inches
Row Spacing: 30 inches
Rows per Plot: 4
Replications: 2
Previous Crop: 2000 – Wheat
Fertilizer: 30 gallons of 8-24-6 with 0.5% zinc banded 1.5 inches below and 1.5 inches to the side of seed
Insecticide: Thimet granules at planting
Herbicide: Accent
Irrigation: Sub-irrigation by spud ditch
Location: Tyler Island

Entry	Number	Stand (plnts/acre)	Days to Bloom	Maize Dwarf Mosiac (%)	Fusarium Ear Rot (%)	Head Smut (%)	Common Smut (%)	Ear Height (in.)	Moisture at Harvest (%)	Bushel Wt. (lbs/bu)	Yield** (lbs/acre)	Duncan's Multiple Range Test (5%)
Northrup King	N83-N5	34147	N/A	0	0	0	1	66	13.5	63.2	14323	A
Asgrow	RX897	35749	N/A	0	0	0	0	62	13.3	61.4	14221	A
Seed Tec	20015	33546	N/A	0	5	0	1	47	13.2	60.8	13750	AB
Seed Tec	20070	34047	N/A	1	1	0	1	48	13.3	61.1	13426	ABC
NC+	NC+5411	32845	N/A	0	0	0	1	49	13.4	61.0	13379	ABC
Mycogen	8070	35048	N/A	1	0	0	0	70	13.6	62.3	13351	ABC
Pioneer	31G98*	33546	N/A	2	0	1	0	57	13.0	61.9	13349	ABC
Pioneer	31G98*	34347	N/A	1	0	0	0	57	13.2	62.5	13309	ABC
Tuleburg	SX5400RR	35549	N/A	0	2	1	0	51	12.9	60.6	13284	ABC
NC+	NC+6868	30142	N/A	0	1	1	0	53	14.2	60.0	13184	ABC
Tuleburg	TS646	32244	N/A	1	0	1	0	52	12.9	59.5	13150	ABCD
Dekalb	DK6410RR	32945	N/A	2	0	1	0	52	13.1	61.1	13104	ABCD
Dekalb	DK647	32244	N/A	0	1	1	0	58	13.8	60.1	12855	ABCD
Northrup King	N7992	32545	N/A	1	2	1	0	59	13.3	62.7	12788	ABCD
Asgrow	RX826RR	30142	N/A	0	0	2	2	56	13.6	61.3	11836	BCD
Pioneer	34M94	32445	N/A	1	0	0	0	46	12.9	60.7	11772	BCD
Sieben***	7730	32845	N/A	2	0	2	0	47	13.3	61.1	11617	CD
Mycogen	8460	33847	N/A	0	4	1	3	61	13.4	60.0	11220	D
	Average	33235		0	1	1	0	55	13.3	61.2	12995	
	C.V.%	0.85		NS	NS	NS	NS	7.0	1.7	0.8	6.2	
	LSD @ 5%	596.71						8.1	0.5	1.0	1703	

*Grower standard variety **Yield adjusted to 15% moisture. ***Seeds provided by Kellogg Seed Service

NS=Not significant due to high variability in the data Note: Bloom date data not taken