University of California, Davis and Riverside campuses, at Tulelake and South Coast Field stations, and in 1974-75 at two additional locations in the San Joaquin Valley. A barley cultivar, Grande, naturally infected with barley stripe, was used in initial screening trials. Later the cultivar Briggs was used to develop a seed source in which about 50 percent of the seed were infected with the stripe fungus. Incidence of barley stripe disease was determined by making stand counts of seedlings, then counting stripe-infected plants shortly after heading and calculating the percent of plants infected.

Chemicals to be screened were applied to seed of both barley and wheat by atomizing with a deVilbis atomizer a suspension of the chemicals onto the seed as they tumbled in a fluted rotating drum. In a few instances certain chemicals could not be applied through an atomizer, and these were applied as slurries. The amount of seed treated was never less than 200 grams for each treatment. Ceresan L (an alkyl mercury) was included in all tests as a standard for comparing performance of test chemicals.

The effectiveness of each chemical tested was based on reduced disease incidence as compared with that in the control, and on consistency of performance among locations and years. A reduction to less than 1 percent was considered adequate control of the diseases under all conditions except in those trials where disease incidence was low in the untreated control. In addition to disease reduction, the following four criteria were established to aid in selecting safe as well as useful compounds: the fungicide should (1) have biological activity equal or similar to that of the mercuries against target organisms; (2) be nonphytotoxic to seedlings; (3) be effective at relatively low rates; and (4) not be appreciably hazardous to man or other animals.

During the course of these studies, over fifty chemicals or combinations of chemicals were screened. PCNB, carboxin, mancozeb, and maneb plus HCB all provided excellent control of seed-borne wheat bunt and were equal to control achieved by the alkyl mercuries (table 2). Many of the fungicides used reduced the incidence of both test diseases, but only those treatments containing carboxin alone or in combination gave consistent control of the deep-seated type of diseases as exemplified by barley stripe disease (table 3). The tests clearly demonstrated that seed-borne disease of winter cereals can be effectively controlled with compounds that do not contain mercury.

TABLE 3. Comparison of Carboxin Fungicides to Alkyl Mercury for Control of Barley Stripe Disease (*Helminthosporium gramineum*)

Location	Year	Untreated check	Ceresan L 1 oz*	Vitavax 200 2 oz	Vitavax 200 4 oz	Vitavax 75 WP 4 oz
Tulelake	1972	13.4	1.8	—	—	—
	1973	5.9	<1	<1	<1	—
	1974	7.9	<1	—	<1	—
Davis	1972	5.8	0	—	—	<1
	1973	1.5	0	0	0	—
	1974	15.2	<1	—	0	—
	1975	7.0	0	0	—	—
Riverside	1972	3.5	<1	—	—	<1
	1973	2.8	0	0	<1	—
	1974	14.4	<1	—	0	—
Kings Co.	1975	11.4	0	—	<1	—

*Rate used per 100 pounds of seed.

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Environmental influences on corn hybrids

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Single- and three-way-cross hybrids, and differences in soil types and climate, have made single-environment testing of corn hybrids inapplicable for variety evaluation. Growers must test varieties under their own growing conditions before making selections.

Most of California's grain corn acreage is in the great Central Valley. Major production is in the Delta—about 50 miles long and 20 miles wide, where Sacramento and San Joaquin rivers converge before entering San Francisco Bay.

For a number of years the University of California used a single site for evaluating corn hybrid varieties from other areas of the United States for adaptation to the Delta production area. This limited program was made difficult to continue by the increasing numbers of hybrids. A change to single- and three-way-cross hybrids also raised questions about the applicability of a single test environment to evaluate these hybrid types. The possibility existed that these types were less uniform in performance from one location to another than older double-cross hybrids.

During 1970 and 1971, a study was made to determine the validity of using a single test location for evaluating corn hybrids for planting in the Delta. Information was needed on the influence of years by weather and location on the relative performance of hybrids.

The study was conducted at seven test sites in each of the two years. Three

sites were in San Joaquin County, three in Sacramento County, and one each in Yolo and Solano counties. Soils at five of the test sites were high in organic matter, typical of the Delta area. The other two sites were characterized by mineral soils more typical of production areas on the fringe of the Delta.

Ten hybrids were selected to provide a sample of both single and three-way crosses. The varieties represented several seed companies and a range of maturities and performances based on previous testing. They were planted at typical Delta population densities: 22,000 and 28,000 plants per acre.

Individual trials were conducted in a split-plot design with two replications. Plant population was the main effect, with hybrids randomized in subplots. Trials were hand-planted and thinned to desired stands, with the two center rows of each four-row plot harvested for yield analysis. Individual rows were 20 feet long. All other cultural practices resembled those used by cooperating growers. Ears were picked by hand and shelled to determine grain yield. Shelled grain was analyzed for moisture, kernel weight, and protein content.

Data were gathered on stand establishment, diseases, lodging, grain moisture, kernel weight, yield per acre, and percent protein in the grain by Kjeldahl analysis. Only one block of the trial at each location was sampled for protein analysis in 1970.

The grand mean for yield over years and locations was 8,890 pounds per acre, with mean location yields for the two years ranging from 6,190 to 11,040 pounds per acre. Means for the varieties ranged from 8,380 to 10,120 pounds per acre (table 1), generally higher than both the state and Delta average yields for corn.

Analysis of the yield data showed significant difference in years, locations, years x locations, populations, hybrids, hybrids x locations, hybrids x years, and hybrids x locations x years. No significant interactions of populations with hybrids, years, or locations were found. The results show that a single test site, or a single year of evaluation, is inadequate to determine the relative performance of a hybrid. Adequate evaluation would require many test sites and several years. Evaluation of varieties should not be generalized without great justification; instead, careful evaluation of variety performance by individual growers seems necessary.

Because corn is a feed grain for several classes of livestock in California, the crop's protein content and the factors influencing it should be known. In an analysis of corn protein values in 1971, significant differences in protein content were found to be due to location, population density, variety, and location x variety. Protein content was not influenced significantly by plant populations and various interactions with populations. The combined analysis with data available from a single block in 1971 also showed a significant hybrid x year interaction.

Mean protein values for 1970 and 1971 are presented in table 2. Actual mean protein ranged from 8.8 to 10.8 percent, the variety with the highest percentage of protein having 23 percent more protein than the variety with the lowest percentage. Varieties with higher grain protein could be selected for feed production if needed. Because of the location and year differences and significant interactions involved, grain protein content would have to be determined on a lot basis at time of grain purchase.

To determine the effect of the environmental factors on grain size, weight per thousand kernels was determined. Significant effects were found for all factors studied and for most interactions. Population size had a significant effect on kernel size. However, there were no significant differences between the interactions with plant populations.

The large number of significant interactions observed in this experiment rule out simple variety evaluation. Even though the Delta area is relatively small, determining the general worth of a variety would require complex procedures. Results indicate that individual growers must carefully evaluate varieties under their own growing conditions before making selections.

TABLE 1. Grain Yields of 10 Varieties Grown in 7 Locations

Two-year mean: yield, pounds per acre @ 15.5% H_2O

Variety	Lower Jones	Ringe Tract	Staton Island	Tyler Island	Ryer Island	Clarksburg	Natomas
1. DeKalb XL347	8955	7997	7321	5442	9428	9848	10403
2. DeKalb XL361	9084	7868	8854	4954	7362	10307	10243
3. Funks Y4384	9717	8762	8977	6609	9082	11004	11694
4. Funks G4550	8876	6953	8179	5782	8388	10184	10387
5. P.A.G. SX 21	9384	7938	9530	7660	9182	10719	11040
6. P.A.G. SX 53	8650	6994	6748	5156	8502	9650	9955
7. Pioneer 3369A	11033	8321	9161	7641	10324	11421	12963
8. Pioneer 3775	9523	8617	8620	5090	7788	10183	11525
9. Vinton 40 × 4	9443	7822	8343	6610	8817	10548	10782
10. Vinton 90 × 5	9702	8009	8643	6966	8490	11060	11425
Mean	**9436**	**7928**	**8437**	**6191**	**8736**	**10492**	**11041**

CV = 7.5%.

TABLE 2. Percent Protein of 10 Varieties Grown in 7 Locations

Brand and variety	Percent protein, two-year mean
P.A.G. SX21	10.8
DeKalb XL361	10.2
Vinton 40 × 4	9.9
Vinton 90 × 5	9.8
P.A.G. SX53	9.8
DeKalb XL347	9.6
Pioneer 3775	9.4
Funks G4384	9.2
Funks G4550	9.2
Pioneer 3369A	8.8
Mean	**9.7**

TABLE 3. Average Yields for all Locations

Variety	Pounds per acre at 15.5% H_2O Over two years plants per acre 22,000	28,000	Over two populations 1970	1971
1. DeKalb XL347	8000	8970	8970	8000
2. DeKalb XL361	8100	8670	8870	7890
3. Funks G4384	9050	9760	9670	9140
4. Funks G4550	8880	8710	8890	7900
5. P.A.G. SX21	9200	9500	9140	9560
6. P.A.G. SX53	7680	8230	8530	7370
7. Pioneer 3369A	9790	10460	10520	9730
8. Pioneer 3775	8480	9050	9300	8230
9. Vinton 40 × 4	8670	9150	9410	8410
10. Vinton 90 × 5	8970	9400	9460	8910
Mean	**8682**	**9190**	**9276**	**8514**

CV = 7.2%.

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ERRATUM for March 1978, "Response of corn to fertilizer, plant population, and planting date," Table 1, page 15:

In the May 30 planting date, 18,000-plant population, the yield for 400 lb N rate should be 10,870 (not 19,870).