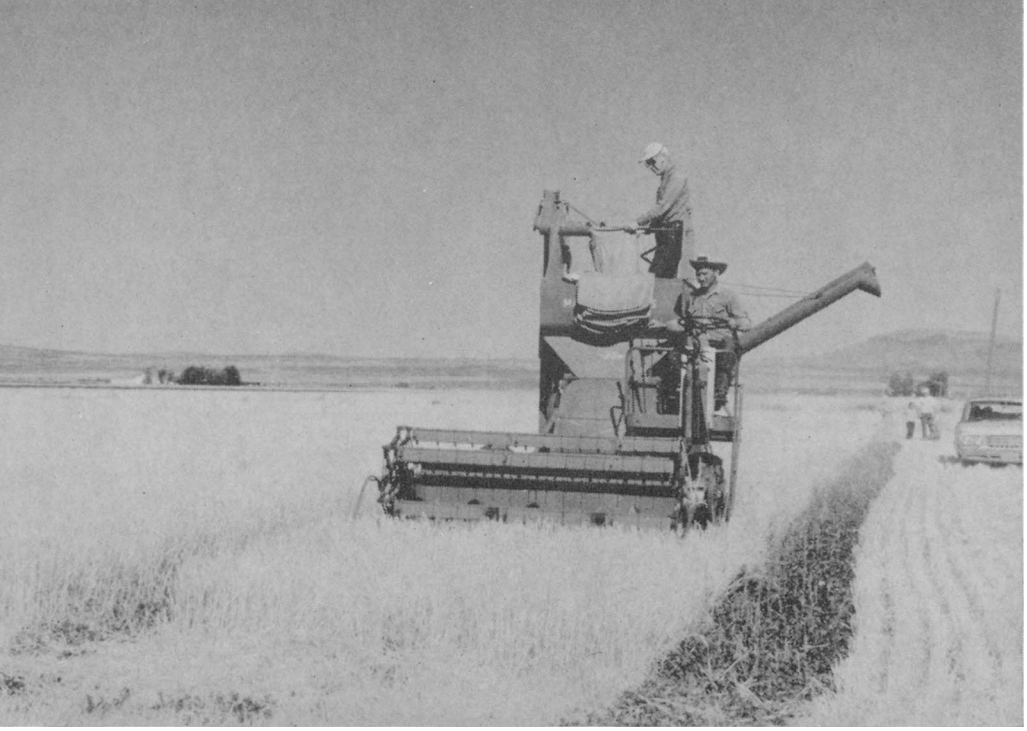


Harvesting Firlbecks III barley in one of the 18 barley variety tests conducted in the Tulelake Basin in recent years. Note shortness of straw height.

Higher barley yields per acre, along with preferred malting characteristics, are possible through properly balancing nitrogen fertilizer applications with prior cropping and soil management patterns. The recently introduced 6-rowed malting varieties, Larker and Traill, showed the greatest nitrogen yield response, and malting quality was least adversely affected by the highest rate used. The release of the 2-rowed malting variety, Firlbecks III, along with Larker and Traill, provides northern California barley growers with a choice of malting varieties which are directly competitive with the high-yielding feed variety, Wocus. All are significantly higher yielding than the formerly popular 2-rowed Hannchen. Stiff-strawed Firlbecks III minimizes the lodging problem so characteristic of the older, 2-rowed Hannchen. Larker and Traill may shatter if grown in districts with windstorms at harvesttime.

THIS REPORT IS A SUMMARY of barley field experiments conducted in the Tulelake Basin of California from 1950 through 1965. A malting barley crop with a yearly gross value of about $4,000,000 has been produced on an area of 40,000 to 50,000 acres. These studies have resulted in a change of varieties and cultural practices recommended for the production of best malting quality barley.

Varietal performance

Because the three types of barley—6-rowed feed, 2-rowed malting and 6-rowed malting—have distinct uses, selection of the most profitable variety depends not only on crop performance, but on unit value to the grower as well. The recognized malting varieties usually return a premium price over feed types, with the highest premium historically being paid for the 2-rowed type. Two-rowed Hannchen was the principal variety grown prior to the testing and joint release of the 2-rowed European variety, Firlbecks III, by the California and Oregon Experiment Stations in 1966.

The comparative performance of the varieties tested in the Tulelake Basin over a five-year period, at numerous locations and in a series of fertilization tests is shown in table 1. A standard seeding rate of 100 lbs, drilled about May 1 each year, was used in all tests. The fertilized plots received 18 lbs of phosphorus (41.2 lbs P_2O_5) per acre as treble superphosphate broadcast preplant and disked in, plus anhydrous ammonium nitrogen treatments as shown in table 1 (drilled in, preplant). All tests were irrigated. The data in the "All tests" section is the most indicative of the comparative varietal yield differences on an areawide basis, as they embrace a wide variety of environmental conditions and fertility levels existing in many fields.

TABLE 1. YIELDS OF BARLEY VARIETIES GROWN IN TULELAKE BASIN TESTS 1961–65

	All tests, including fertilizer trials			Fertilizer tests (1961–63)		
	18 tests (1961–65)	12 tests (1962–65)		Pounds of nitrogen applied per acre‡ 0	42	84
	Production in pounds per acre*		Percent of Hannchen	Production in pounds per acre*		
Wocus	5191a*	5294a	145	4877a	5369a	5890a
Firlbecks III	4961 b	5078a	139	4543 b	5248ab	5473 b
Larker†	..	4705 b	129	4251 c	4985 bc	5835a
Traill	4489 c	4618 b	127	3853 d	5030 b	5839a
Trophy†	..	4156 c	114	3763 d	4753 c	5045 c
Hannchen	3563 d	3644 d	100	3393 e	3597 d	3793 d

* Means followed by same letter are not significantly different at 0.05 level of probability.

† Fertilizer data for these varieties based on two years' tests; adjusted on basis of two years' data for all varieties.

‡ The control and nitrogen plots received 18 lbs of phosphorus (41.2 lbs P_2O_5) per acre.

Firlbecks III, significantly higher in yield than Hannchen, provides malting barley growers with a new 2-rowed premium malting variety that gives a yield competitive with the high-yielding 6-rowed feed variety, Wocus. This competitive yield relationship is extremely important in years when barley quality fails to meet malting and brewing standards and must be sold for feed prices. The 6-rowed malting varieties, Larker and Traill (approximately equal in yield), were slightly lower yielding than Firlbecks III and Wocus. A third 6-rowed malting variety, Trophy, was significantly lower in yield and is not recommended for production in the Tulelake Basin.

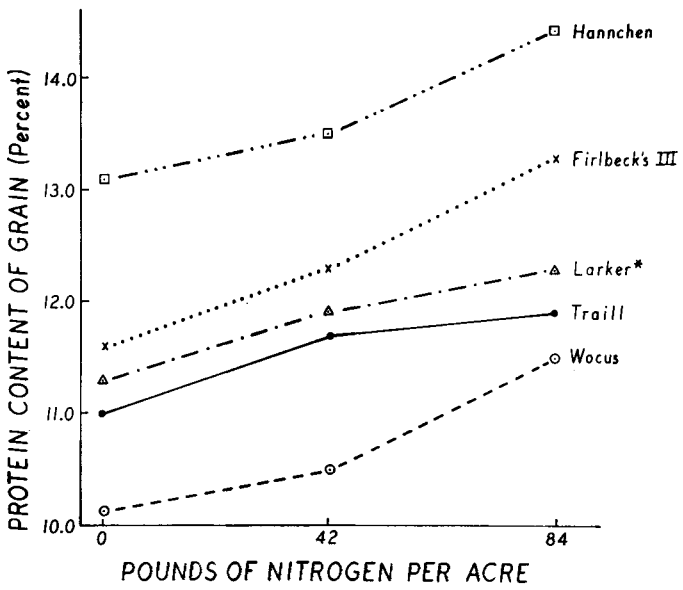
Fertilization

Some varieties showed a strong response to fertilizer applications—a factor to be considered when selecting a variety. Varietal response to three nitrogen levels is given in table 1. Where only phosphorus and no nitrogen was applied, the varieties maintained the same yield relationship as in the average of all the tests, except for a wider spread in performance between Larker and Traill—suggesting that Traill requires a higher nutrient level for maximum yield. The midwestern types (Larker, Traill, and Trophy) showed the greatest response to nitrogen and Hannchen the least. There was a change in the yield rankings of varieties at the 84 lb nitrogen application rate

Response of SIX BARLEY VARIETIES *to selected cultural practices*

K. G. BAGHOTT • C. W. SCHALLER • M. D. MILLER

PROTEIN RESPONSE OF VARIETIES TO RATES OF NITROGEN



* See table 1.

(table 1). At this nutrient level, yields of Traill, Larker, and the feed barley Wocus were equal and all were significantly larger than Firlbecks III.

Grain quality

Some of the physical characteristics used by buyers of barley for malting purposes in judging grain quality include brightness, plumpness, and mellowness of kernels. Chemically, the grain-protein-content upper limit preferred for 2-rowed varieties is 12 per cent whereas that for 6-rowed varieties is 12.5 per cent. Malt made from barley significantly higher in protein than these levels is difficult to process into quality beer.

The graph shows the effect of various increments of nitrogen upon the protein content of the five different varieties grown in experiments for three years. The 2-rowed varieties, Hannchen and Firlbecks III, showed a strikingly higher protein content with increasing rates of nitrogen. A comparison of the varietal protein response with the varietal yield response (table 1), indicated that varieties responding least in yield to applications of nitrogen tended to show the greatest increase in grain protein content. This means that overfertilizing malting varieties having a comparatively low fertilizer yield response, can result in undesirably high protein levels in the grain. Conversely, yield-responsive varieties such as Traill and Larker apparently can utilize higher amounts of nitrogen without exceeding acceptable protein levels.

Bushel test weight (a measure of kernel plumpness) also was slightly influenced by nitrogen treatment in these experiments (table 2). Firlbecks III was affected only by the highest nitrogen rate, whereas Traill and Larker were unaffected by increasing nitrogen from 42 lbs to 84 lbs per acre.

Cropping systems

Two-rowed barley varieties following heavily fertilized row crops, such as potatoes or onions, generally produce high yields but often contain a protein content considered excessive for malting purposes. The protein range of Hannchen barley samples collected from 189 fields was studied from 1953 to 1958 to determine the effect of prior cropping patterns on yield and quality (table 3). No fertilizer was applied to the fields during the year of the barley crop except where barley followed barley. Protein was exces-

TABLE 3. EFFECT OF CROPPING PATTERN ON HANNCHEN BARLEY PROTEIN CONTENT

Previous Crop	Sample	Protein (average)
	No.	%
Potatoes	49	14.81
Legumes (clover or alfalfa)	38	12.79
Barley	102	11.97

TABLE 4. EFFECT OF SEED BED PREPARATION METHODS ON YIELD*

Land preparation	Not cultipacked	Cultipacked
	Yield	
	Pounds per acre	
Disc	3720	3840
Plow	3440	3790
Chisel	3570	3780

* Work cooperative with U.S. Fish and Wildlife Service.

TABLE 2. EFFECTS ON TEST WEIGHT OF FERTILIZATION ON BARLEY VARIETIES

Variety	Pounds nitrogen per acre*		
	0	42	84
	Test weight in pounds per bushel		
Hannchen	51.2	50.0	49.0
Firlbecks III	52.2	52.0	50.0
Larker	51.0	49.0	49.0
Traill	50.0	49.0	49.0
Wocus	48.0	47.0	46.0

* The control and both levels of nitrogen received 18 lbs (41.2 lbs P_2O_5) of phosphorus per acre.

TABLE 5. EFFECT OF BARLEY SEEDING RATE ON YIELD AND PLANT DEVELOPMENT

Seeding rate	Yield*	Plants/ 72" of row	Tillers/ 72" of row	Kernels per head	1000-Kernel weight	Protein
Lbs/A	Lbs/A	No.	No.	No.	gms.	%
32	3579	38	263	26.91	47.1	12.06
52	3520	53	299	24.56	44.6	12.21
73	3670	71	313	23.60	43.9	12.21
127	3660	96	320	22.03	41.0	12.14

* Yield not significantly different at the 5% level.

sively high following potatoes, and lowest following barley.

Tillage practices had little effect on yield or grain protein percentage of Hannchen barley. The results of a three-year study, in a cooperative project with the U.S. Fish and Wildlife Service, involving 4-acre, replicated plots comparing disking, plowing, and chiseling are summarized in table 4. Following the basic spring disking or plowing or chiseling, all plots were similarly fertilized, harrowed, and then drill-seeded

Although not statistically significant, there was a small but consistent yield advantage for cultipacking following seeding. This was especially true in the case of the plowed or chiseled plots. There was considerably less plant injury from frost at stand establishment time in the cultipacked, as compared to the non-cultipacked plots.

In these trials, four different seeding rates were superimposed on the disked treatment. Yield was not affected within the range of seeding rates used in the experiment (table 5). However, excessive weed and wild oat growth was evident at the lower rates (32 lbs and 52 lbs per acre)—and consequently, these rates are not recommended for commercial practices.

Although final yield was not affected by any of the rates used, varying the seeding rate had a significant effect on individual yield components. Despite increased tillering at the lower rates (6.9 versus 3.3 tillers per plant at the 32-lb and 127-lb rates per acre, respectively), the number of tillers per unit area was smallest at the lightest rate, and greatest at the highest rate. The increase in tiller number was offset by fewer kernels per head and significantly lighter kernels at the higher rates. It appears that excessive seeding rates, resulting in smaller kernels, can have a deleterious effect on quality, as measured by lower test weight and greater clean out. Lodging was highest at the higher seeding rates.

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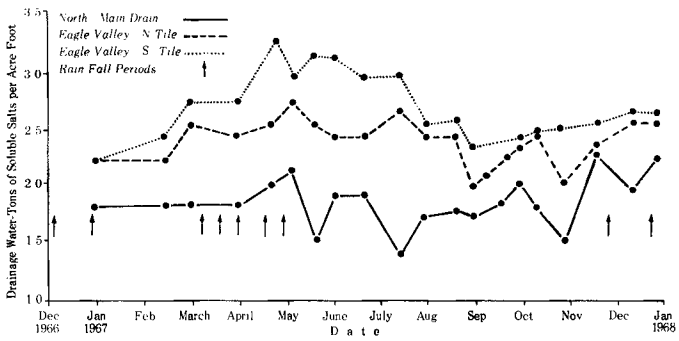
Cooperation in the malting quality determinations was received from USDA Barley and Malt Laboratory, Madison, Wisconsin; Joseph Schlitz Brewing Co., Milwaukee, Wisconsin; Great Western Malting Co., Vancouver, Washington; and Newell Grain Growers Association, Tulelake, California.

SOLUBLE SALTS

in drainage waters and soils of recent citrus plantings in southern California

TONS OF SALT PER ACRE-FOOT OF EAGLE VALLEY DRAINAGE WATERS AT SAMPLING PERIODS DECEMBER 29, 1966, TO DECEMBER 27, 1967—AND RAINFALL PERIODS IN RELATION TO SALT.



R. B. HARDING

APPROXIMATELY 350 acres of alluvial valley soils in southern California are being lost to urbanization each day according to estimates by the University of California Agricultural Extension Service. Whether or not this loss of the better agricultural lands continues at the same rate, it is a fact that less desirable upland soils are already being developed for citrus as well as for other crops. Much of the area being planted in Riverside and San Diego counties includes rolling soils underlain at various depths by bedrock. The type of topography characteristic of these upland areas is shown in the photos.

The soils of three districts north, west, and south of Lake Mathews are typical, having been developed on: (a) granitic, or closely associated light colored rock; (b) gabbro, or rock in which dark minerals predominate; and (c) sedimentary rock which was deposited by water and later hardened into stratified, fine-grained material such as sandstone or shale. The soils developed from these various rocks have different physical and chemical properties and, therefore, each one must be managed somewhat differently. Studies now in progress are being made to determine, over a period of years, what management practices are most desirable. Each of the three districts uses Colorado River water which contains about one ton of salt per acre-foot.

Drainage problems in the area west of Lake Mathews, generally known as Eagle Valley, are likely to be more critical than those of the area north of the lake. In the area south of the lake, drainage appears to be satisfactory and soil salinity has actually declined over the short period (four years) since trees have been planted.

The soils north of Lake Mathews include a few locations where excessive salts have occurred. No tile has been