Barley Response to Water and Nitrogen, 1988

B. Roth, B. Gardner and B. Tickes

ABSTRACT

Results from 1988 show that yields of 3.9 and 3.7 tons per acre are feasible for Gustoe and NK X-1558 barley cultivars. The short season cultivar Barcott yielded about one ton less. The predicted optimum amounts of water and nitrogen were approximately 30 inches and 150 pounds per acre, respectively.

INTRODUCTION

Water and nitrogen management is crucial for optimum barley production. Deficient or excessive water or nitrogen applications can reduce barley yields. The grower needs to know how barley yields change when different amounts of water and nitrogen are applied. Water-nitrogen production functions will provide the grower with this information.

MATERIALS AND METHODS

A self-moving, lateral, sprinkler irrigation system was modified to apply various levels of water and nitrogen accurately. The amount of water applied ranged from 50% to 150% and the nitrogen levels varied from 33% to 167% of the optimums. The optimum amount of water applied was determined by using a neutron moisture meter to schedule irrigations so that an adequate moisture level was maintained. Tissue analysis was used to verify that adequate levels of nitrogen were maintained in the plant tissue.

This study was done at the University of Arizona Yuma Mesa Agricultural Center. The soil was a Superstition sand, with an infiltration rate of about 3 inches per hour. The irrigation water used was Colorado River water, with an average total soluble salt content of about 1000 ppm.

Four barley cultivars (Gustoe, Barcott, Fiesta and NK X-1558) were planted on December 15, 1987 at a rate of 120 pounds per acre, with a small plot grain drill to simulate normal planting procedures. These varieties were selected because they are commercially available.

All plots were irrigated uniformly from December 15 until January 3 to accomplish uniform germination and initial plant growth. During this germination period, 1.4 inches of irrigation water and 0.7 inches of rain were applied. On January 4, the different water and nitrogen treatments were imposed. Two irrigations were made weekly until mid-April when they were increased to three irrigations weekly. The amount of water received by the 100% plots during this period was 21.7 inches of irrigation water and 1.3 inches of rainfall. Nitrogen fertilizer was applied in the irrigation water twice monthly during the months of January, February and March at a rate of about 15 pounds per acre. All cultivars were harvested on May 17.

RESULTS AND DISCUSSION

Barley yield results are shown in Table 1. Yields increased with incremental water and nitrogen applications for all cultivars. The yield data for each cultivar were fitted by regression to a quadratic equation. These equations were used to predict yield for the range of water and nitrogen applied. The yield contours in tons per acre are shown in Figure 1 for the four cultivars. Generally barley yields increase to incremental water and nitrogen applications to a maximum and then decreased for Gustoe, NKX-1558 and Barcott cultivars. Insufficient water and nitrogen were applied to the cultivar Fiesta to obtain the optimum yield. It appears that this cultivar could require applying more than 40 inches of water and more than 200 pounds of nitrogen per acre.

A maximum yield of 3.9 and 3.7 tons per acre was predicted when 30 inches of water and 140 pounds per acre of nitrogen was applied to the Gustoe and NK X-1558 cultivars, respectively. The maximum yield predicted for the Barcott cultivar was about 1 ton per acre less (3.1 tons/acre) when 29 inches of water and 170 pounds per acre of nitrogen was applied. Barcott is a shorter season cultivar, and it matured about 3 weeks earlier than the other cultivars. The optimum yields for the Fiesta cultivar could not be predicted for the amounts of water and nitrogen applied in this study.

Table 1. 1988 Summary of Barley Yields

NO	WATER APPLIED*	NITROGEN APPLIED	YIELD			
			BARCOTT	FIESTA	GUSTOE	NKX-1558
	in	lb/ac	tons/acre			
1	14.2	97	1.9 b**	1.3 c	1.9 a	1.2 a
2	17.5	51	1.0 ab	1.0 b	1.5 a	1.4 a
3	17.5	142	2.3 c	1.7 d	2.6 b	1.8 a
4	25.1	32	0.7 a	0.7 a	1.3 a	1.3 a
5	25.1	97	2.4 c	2.0 d	3.4 c	3.3 b
6	25.1	162	3.0 d	2.8 f	3.7 c	3.0 b
7	32.7	51	0.9 ab	1.9 d	1.7 a	1.4 a
8	32.7	142	2.7 cd	2.6 e	3.6 c	3.7 b
9	36.0	97	1.3 b	1.7 d	3.0 c	2.5 ab
		s_x	0.012	0.002	0.014	0.055

* Includes 1.4 inches germination water and 2.0 inches rainfall.

** Means followed by the same letter are not significantly different at the 5% level.

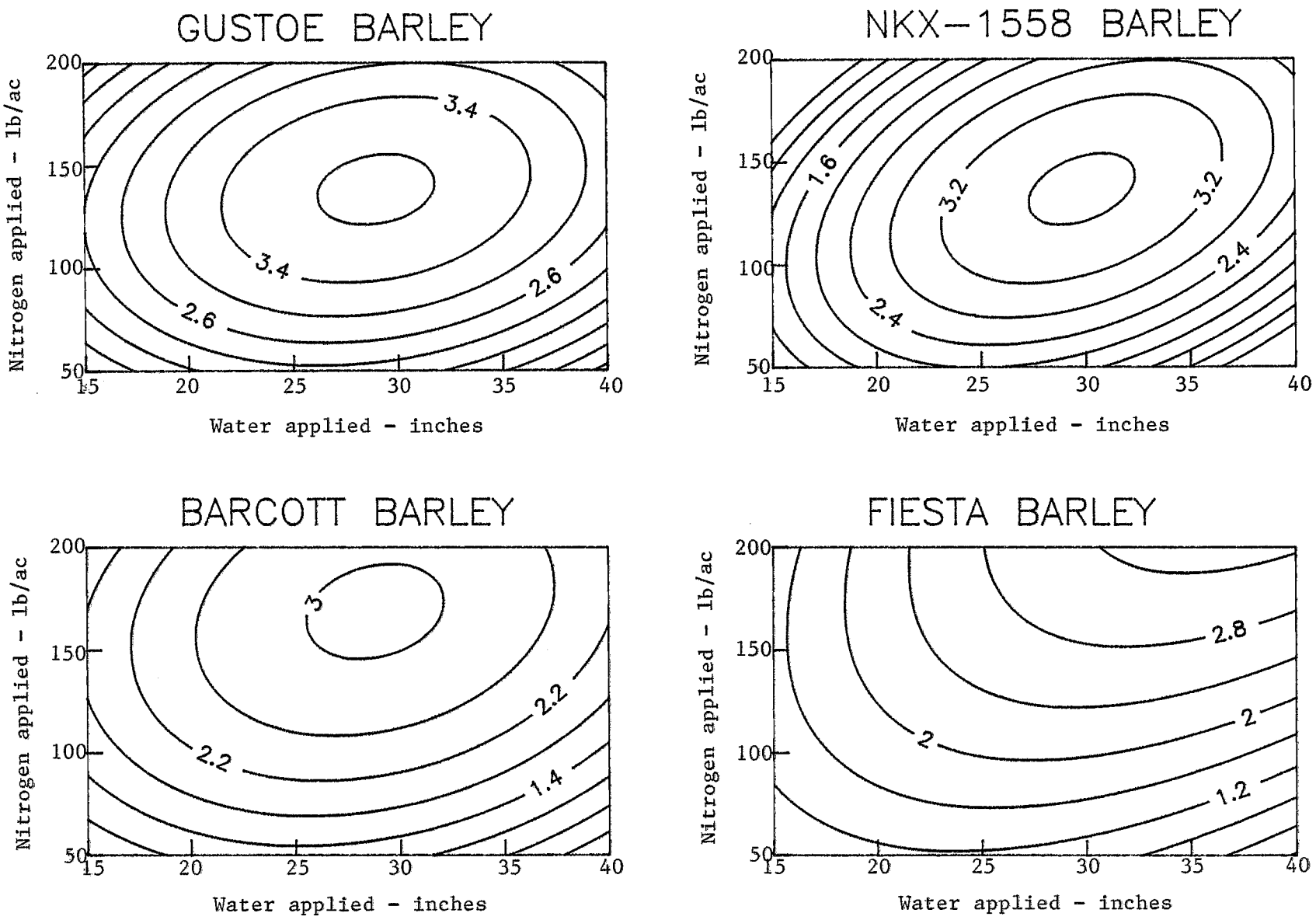

Figure 1. 1988 Barley cultivar responses to water and nitrogen (contour interval = 0.4 tons/acre).