THE INFLUENCE OF SOWING TIME ON WHEAT YIELDS AT TWO IRRIGATION LEVELS

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ABSTRACT

Three wheat cultivars, Aotea, Hilgendorf and Kopara were sown at monthly intervals in May, June and July in two seasons. A comparison was also made between two irrigation levels, applied at nil and 25% available soil moisture.

In the first season there were grain yield differences between cultivars, with Kopara, Aotea and Hilgendorf in descending order. Yields of all three cultivars decreased with later sowing. The heavier irrigation rate gave higher grain yields than the lower irrigation rate on all cultivars and the differences between rates increased with later sowing.

In the second season there were again yield differences between cultivars but the order of precedence of Kopara and Aotea was reversed. Time of sowing and irrigation intensity had no significant effect on grain yield.

INTRODUCTION

A large proportion of the winter sown wheat grown on the lighter soils in Canterbury is sown after the first of June, following the recommendations of Lowe (1967) who showed that this was the earliest safe sowing date for avoiding attacks by the cereal aphid [**Rhopalosiphum padi** L.]. Crops emerging after the middle of June are considered to have a good chance of avoiding attacks by autumn flights of aphids and the subsequent spread of barley yellow dwarf virus. June sowing is generally possible on these soils but the intervention of wet weather can cause delays to sowing operations. A series of experiments was designed to examine the effect of delayed sowing, using three sowing dates at monthly intervals during the winter months on three wheat cultivars, Aotea, Hilgendorf and Kopara.

Drewitt and Rickard (1971) reported large grain yield responses to one irrigation applied during the booting/flowering phase on winter-sown Aotea wheat in four seasons with no significant additional yield with three or four irrigations. Also at Winchmore Irrigation Research Station, work on spring-sown wheat showed significant yield increments with increasing irrigation frequency up to three applications. The present study was carried out at two irrigation levels, one requiring a low number and the other a relatively high number of applications. This paper gives the results of the first two seasons in the series which commenced in the 1972-73 season.

EXPERIMENTAL

The experiments were conducted at the Winchmore Irrigation Research Station on Lismore stony silt loam in the two seasons 1972-73 and 1973-74.

Both experiments were carried out on the same site, 1972-73 was sown as a first crop after three and a half years in pasture. Sowing times were comparable for the two seasons on these dates: May 24, 25; June 21; July 21, 19 for 1972-73 and 1973-74 respectively.

Seeding rates were adjusted to give an equal number of seeds per unit area, and were held constant for each sowing time and varied only slightly between seasons. In both seasons, 23 kg P/ha as superphosphate was applied with the seed, the 1973-74 experiment received in addition 40 kg K/ha as sulphate of potash at sowing and 30 kg N/ha as calcium ammonium nitrate topdressed at the end of tillering.

Irrigation was by the border-strip method and was applied when available soil moisture in the top 150 mm had fallen to nil (wilting point) or 25%. A split plot design was used with irrigation as main plots, time of sowing as sub plots and varieties as sub-sub plots; there were five replications. In the analysis of the 1973-74 yield data the results of the previous season were used as a covariate.

RESULTS AND DISCUSSION

In 1972-73 one irrigation was required on the treatment irrigated at nil available soil moisture (ASM), four irrigations were required on May and June and three on July sowing on the treatment irrigated at 25% ASM.

Analysis of grain yield data showed significant main effect differences between irrigation level, times of sowing and cultivars. (Table 1)

TABLE 1: Main effects of irrigation, time of sowing and cultivars on grain yield, 1972-73.

	Grain yield kg/ha
Main plot: Irrigation	
Irrigated at nil ASM	3800 bB
Irrigated at 25% ASM	4570 aA
Sub Plot: Time of sowing	
May	4580 aA
June	4190 bB
July	3800 cC
Sub-sub plot: Cultivars	
Aotea	4320 bB
Hilgendorf	3470 cC
Kopara	4780 aA

There were no significant interactions.

Grain yields were higher on the more heavily irrigated treatment and at the earliest sowing date, with significant depressions with each monthly delay in sowing time. Kopara was the highest yielding cultivar and Hilgendorf the lowest.

The mean yield difference between the two irrigation treatments was 770 kg/ha; this difference increased with later sowing but was more pronounced between June and July sowings as shown in Table 2.

TABLE 2: Yields of three cultivars and three sowing dates at two irrigation levels, 1972/73.

Time of sowing and cultivar	Grain Yield (kg/ha) Irrigated at nil ASM	Irrigated at 25% ASM	Yield increased at 25% ASM
Aotea			
May	4330	5050	720
June	3810	4670	860
July	3450	4560	1110
Hilgendorf			
May	3630	4170	540
June	3250	3830	580
July	2520	3380	860
Kopara			
May	4880	5380	500
June	4400	5150	750
July	3920	4950	1030

The mean cultivar yield increase with the heavier irrigation rate was 590, 730 and 1,000 kg/ha for May, June and July sowing respectively. On all three cultivars one irrigation applied to May sown crops gave almost the same yield as the three irrigations applied to July sown crops.

The decrease in yield with later sowing was greater at the lower irrigation rate, this is also shown in Table 2. Late sowing was most severe on Hilgendorf where the loss of yield between May and July sowing averaged 24% compared with 14% for Aotea and Kopara.

In 1973-74 one irrigation was required on the treatment irrigated at nil ASM and three irrigations were required at 25% ASM.

Grain yields were considerably lower than in the previous season. There were no main effect differences between irrigation treatment or between sowing times, but the cultivars differed significantly, Table 3.

The time of sowing by cultivar interaction was significant at 1%.

In contrast to the previous season there were no consistent trends with irrigation rate and Aotea was higher yielding than Kopara; Hilgendorf was again the lowest yielder.

May was the optimum sowing time for Aotea, the advantage of sowing Kopara in May or June was the only very slight and Hilgendorf did not vary with sowing time.

Shoot emergence of the May sown crops did not occur until the fourth week in June and whilst some small patches of barley yellow dwarf virus were present they did not become widespread. Crops were considered to be

TABLE 3: Main effects of irrigation, time of sowing and cultivars on grain yield, 1973-74.

	Grain yield kg/ha
Main plot: Irrigation	
Irrigated at nil ASM	2740 a
Irrigated at 25% ASM	2840 a
Sub plot: Time of sowing	
May	2870 a
June	2780 a
July	2720 a
Sub-sub plot:	
Aotea	2970 aA
Hilgendorf	2610 cC
Kopara	2770 bB
C.V.%	7.8

only slightly infected with virus and the harvested grain was well filled in both seasons.

The rate of plant development was parallel in the two seasons and the stage of growth of all cultivars became simultaneous at the booting stage in early November. The development of Hilgendorf moved slightly ahead of Aotea and Kopara at the ear emergence stage.

The lower overall yields in 1973-74 were no doubt partly due to lower fertility; the winter of 1973 was exceptionally wet and the reserves of nitrogen in the soil, already reduced in the previous season, would be further exhausted through the leaching of nitrate nitrogen. Ludecke (1972) related NO_3 -N losses to winter rainfall and also recorded lower levels of NO_3-N with successive cropping. In the experiments reported herein NO_3 -N in the top 150mm of fallowed soil was 47ppm and 16ppm on 20 September in 1972 and 1973 respectively.

Although no data were obtained, the rate of tillering in 1973 was observed to be much lower than in the previous season and the consequent lower number of ears at harvest is thought to have had considerable bearing on the final yield. The nitrogen fertilizer topdressing was too late to influence the number of tillers produced.

The yield response to the heavier irrigation rate in 1972-73 contrasts with earlier irrigation experiments reported by Drewitt and Rickard (1971); in these, one irrigation applied at wilting point was as effective as three or four irrigations spread throughout shooting to maturity. It may be argued that the lower fertility in 1973-74 imposed a limitation on yield potential which was reached with only one irrigation, but there is insufficient evidence to support this view.

The results of these two experiments have been inconclusive and further work is needed to expand our understanding of the interrelated influences of soil fertility, moisture and climate on wheat yield.

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