Growing Irrigated Lentil

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ABSTRACT

Since 1987, research was conducted at the Saskatchewan Irrigation Development Centre (SIDC), Outlook, to develop technology suitable for irrigated lentil (*Lens culinaris* Medikus) production. Diverse germplasm and various management practices were evaluated. Under irrigation, Eston, CDC Richlea, and Rose lentil produced higher seed yield than Laird. Supplemental irrigation of Eston produced marked yield increases in the low rainfall years. For example, in 1988 which received 95 mm (3.8 in) of precipitation during the growing season, addition of 130 mm (5.1 in) and 225 mm (8.9 in) of water produced approximately a 5-6 fold yield advantage. Excessive irrigation in wet years or at flowering reduced yield, likely through excessive vegetative growth and increased disease incidence. Under excess moisture conditions, Eston and Laird were more susceptible to diseases than CDC Richlea, or 458-57. Seeding rates (100 plants/m^2, i.e. 9-10 plants/ft^2) and row-spacing (20 cm, i.e. 8 in) recommended for dryland production appeared suitable for irrigation although in one year, positive yield responses were obtained up to a population density of 175 plant/m^2.

INTRODUCTION

Lentil (*Lens culinaris* Medikus) is an important source of protein in human diet. Lentil straw is used as a feed supplement for livestock in many countries. Saskatchewan is a major lentil producer in the world and the production has increased rapidly in the province during the last 20 years. In 1993, an estimated 303500 ha was seeded to lentil in Saskatchewan compared to 280 ha in 1974.

Lentil genotypes have diverse growth habits and yield potential. Hamdi et al. (1992) identified distinct groups of lentil genotypes on the basis of their response to varying moisture conditions: e.g. genotypes adapted to high moisture situations and those less adapted to wetter conditions. The latter group comprised of late maturing types from northern latitudes. Small seeded 'Eston' and Large seeded 'Laird' are the commonly grown lentil cultivars in Saskatchewan. Eston is slightly less vigorous and earlier maturing than Laird.

Lentil is predominantly grown under dryland conditions. Research in India and New Zealand showed that supplemental irrigation has produced positive yield responses particularly in the arid regions (McKenzie and Hill,1990) and on light textured soil (Singh et al. 1983). Research in Alberta (McKenzie and Clark, 1990) and in New Zealand (McKenzie and Hill, 1990) showed that over-watering resulted in significant yield reduction. Moisture stress, particularly at the reproductive phase (Erskine and Goodrich, 1991), can severely reduce seed yield. For example, in 1988 (the drought year in Saskatchewan), the provincial average lentil yield was only 411 kg/ha compared to a recorded maximum of 1576 kg/ha in 1990. Tests conducted in Alberta (McKenzie and Clark, 1990) showed that Laird produced highest yield at a water use level of 190-280 mm and Eston at a moisture level of 260-300 mm. It is likely that supplemental irrigation can ensure consistent production by alleviating moisture stress, provided irrigation is done judiciously. The development of diseases tolerant/resistant lentil cultivars by the Crop Development Centre, University of Saskatchewan is an added advantage for irrigated lentil production where the incidence of diseases can be comparatively high.

SIDC has evaluated suitable germplasm and appropriate agronomic practices for irrigated lentil production since 1987. A brief summary of research conducted 1987 through 1993 is presented in this paper.

RESULTS AND DISCUSSION

Cultivar Evaluation

Several registered cultivars and advanced breeding lines were tested under irrigation to identify germplasm having characteristics such as early-maturity, disease (e.g. ascochyta, anthracnose, sclerotinia) tolerance/resistance, suitable plant architecture, and growth habit. The more vigorous, late-maturing Laird consistently produced lower seed yields than early-maturing, less vigorous Eston or the intermediate types CDC-Richlea and Rose (Table 1).

Seeding Rate and Row Spacing

The effects of seeding rates and row spacing on seed yield under irrigation were studied in 1990 and 1991. Seeding rates had no significant effect on yield in 1990 (Table 2). In 1991, a progressive increase in seed yield was observed up to a seeding rate of 175 plants/m^2. The 10 cm row spacing produced slightly higher yield than 20 cm spacing, but the differences were not significant.

Table 1. Seed yield of lentil genotypes under irrigated production: 1988 to 1992.

	Seed yield (kg/ha)				
Cultivar	1988	1989	1990	1991	1992
Eston	2773	2167	4475	2743	1460
Laird	1738	1672	2979	1290	1398
CDC-Richlea	-	2022	3951	2270	1503
Rose	3156	2008	4254	-	-
LSD (5.0%)	661	328	621	330	474
C.V. (%)	18	13	12	12	27

Table 2. Seeding rate and row-spacing effects on seed yield of Eston lentil: 1990 and 1991.

Treatment	Yield (kg/ha)	
Seeding rate (plants/m^2)	1990	1991
100	4572	3553
125	4821	3762
150	4722	4020
175	4471	4462
200	4474	4187
LSD (5.0%)	425	570
Row spacing (cm)		
10	4625	4129
20	4599	3830
LSD (5.0%)	269	449
C.V. (%)	9	17

Irrigation Scheduling

In drought years, lentil responded favourably to increased moisture supply. In wet years, the influence of additional water on productivity was less pronounced and excessive moisture during the crop production period caused considerable yield losses. For example, in the dry year of 1988 in which the dryland plots received 95 mm of rain, irrigated plots recorded a 5 to 6 fold yield increase over the dryland treatment (Table 3). In 1990, which received 231 mm of rain during the growing season, supplemental irrigation (183 mm) produced 19% higher seed yield than the dryland crop. In the cool wet (306 mm rainfall) year of 1993, moderate irrigation (76 mm) caused severe yield reduction compared to the dryland plots (Table 3). In 1993, the yield losses due to supplemental irrigation was more marked for Laird than Eston.

In a relatively wet season (e.g. 1992), application of irrigation water during flowering and pod development caused appreciable yield losses compared to when irrigation was restricted to early crop development phase (Figure 1). The 1993 (a wet year) study also showed that irrigation at the flowering stage reduced seed yields compared to treatments that did not receive water at flowering (data not presented).

Diseases

Diseases such as ascochyta blight, anthracnose, and sclerotinia can cause severe damage to lentil under high moisture situations. The influence of irrigation on the incidence of diseases were studied during 1991 through 1993. Irrigation tended to increase the incidence of diseases. In 1993, irrigation increased the incidence of anthracnose relative to the dryland plots (Figure 2). The breeding line 458-57 exhibited lower level of infection than CDC-Richlea or Eston.

Table 3. Yield responses of Eston and Laird lentil to supplemental irrigation; 1989, 1990, and 1993.

Treatment	In-season rain (mm)	Irrigation (mm)	Seed yield (kg/ha)
1989-Eston			
Dryland	95	0	550
Irrigation - 1	95	130	2530
Irrigation - 2	95	225	3349
LSD (5.0%)			438
C.V. (%)			13
1990-Eston			
Dryland	231	0	2513
Irrigated	231	183	2983
LSD (5.0%)			502
C.V. (%)			11
1993			
Eston			
Dryland	306	0	2657
Irrigated	306	76	1655
Laird			
Dryland	306	0	1547
Irrigated	306	76	818
LSD (5.0%)			271
C.V. (%)			17

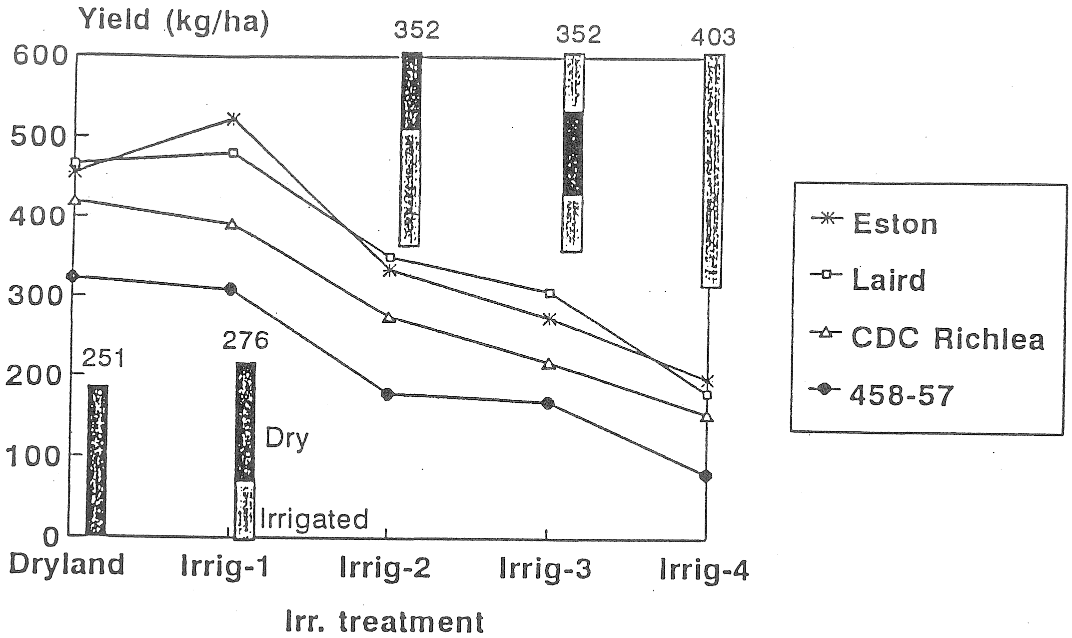

Figure 1. Yield responses of lentil cultivars to irrigation at different crop growth stages.

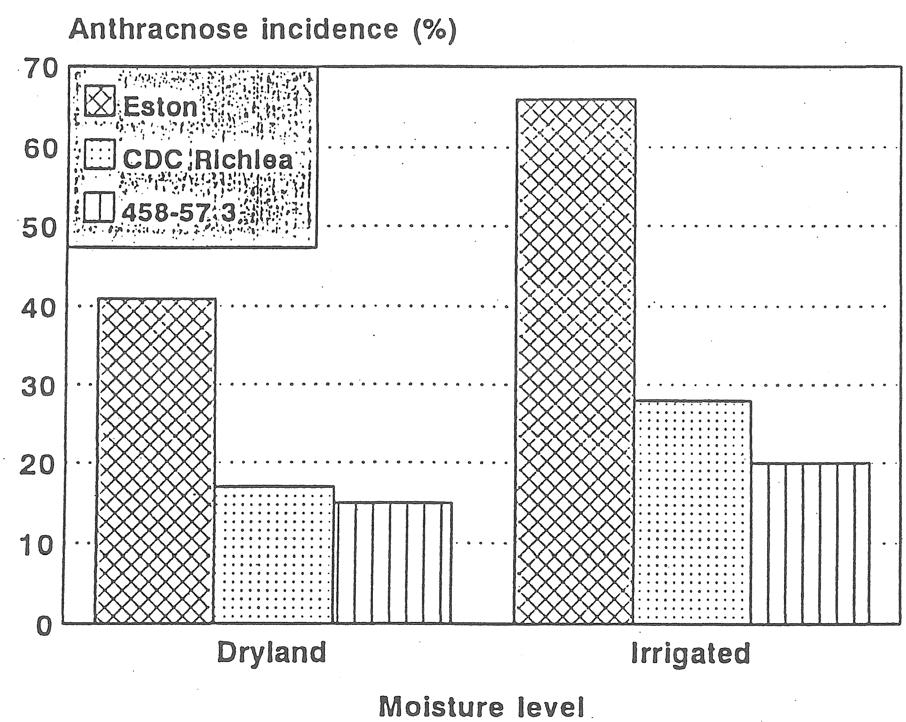

Figure 2. Incidence of anthracnose in different lentil cultivars as influenced by irrigation: 1993

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