

Effects of supplemental irrigation on berseem seed crop in a semi-arid Mediterranean environment

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Introduction Berseem seed production in Mediterranean environments is strongly influenced by soil water availability, particularly during spring growth. A long-term study (11 years) in Sicily recorded seed yields of between 0 and 1600 kg/ha, for an annual rainfall range of 289 to 867 mm (Stringi *et al.*, 2001). It was proposed that water irrigation during sensitive growth stages could increase and stabilize seed yield. This research investigated the response of berseem seed crop to low levels of irrigation applied at different growth stages.

Materials and methods Field trials were conducted for 2 years (1999/00 and 2000/01) in a typical, semi-arid Mediterranean environment of Sicily, Italy (37°33'N, 13°30'E, 150 m a.s.l) on a vertic xerochrept. The experiments were arranged in a randomised block design with 4 replications. Recommended cultural practices for a berseem seed crop were applied. The seed of cv Lilibeo was sown on 8 January 2000 and 12 December 2000 at the rate of 30 kg/ha. The crop was cut on 13 April 2000 and 3 April 2001 and herbage was removed. During the first trial year 5 irrigation treatments were applied: RC, rainfed control (not irrigated); AC, 1 irrigation (irr.) soon after the cut; EB, 1 irr. at early bud; 2I, 2 irr. soon after cut and at early bud; IC, irr. control, 3 irr. at vegetative stage (VS, 30 March), AC and EB. During the second trial year a sixth treatment was included: EF, 1 irr. at early flower; in IC 4 irr. were applied including VS (29 March) AC, EB and EF. Water was applied to the plots using overhead sprinklers at the rate of 40 mm during each irrigation session. Compared to average conditions, 1999/00 was very dry, particularly in autumn and spring, with a total rainfall of 393 mm (26% less than normal) and temperatures were lower in winter and higher in autumn and spring, whereas 2000/01 was quite wet with a total rainfall of 620 mm (16% above normal) and higher temperatures throughout the cropping season, particularly in spring.

Table 1 Seed yield (SY, kg/ha) and total above-ground dry biomass at seed harvest (BY, t/ha) of berseem for the various irrigation treatments in the two cropping seasons

Irrigation treatment	SY		BY	
	99/00	00/01	99/00	00/01
Rainfed control (RC)	398 b [†]	1240 d	2.6 c	6.5 c
1 irr. after cut (AC)	392 b	1240 d	3.1 b	7.0 b
1 irr. at early bud (EB)	515 a	1550 b	3.7 b	7.7 b
1 irr. at early flower (EF)	n.a. [§]	1690 a	n.a.	7.1 b
2 irr. AC and EB	512 a	1390 c	4.8 a	7.8 b
3-4 irr. (VS, AC, EB, EF [#])	571 a	1420 c	5.6 a	8.7a

[†] Means followed by the same letter are not significantly different (Fisher's protected LSD test at $P \leq 0.05$). [§] n.a., treatment not applied. [#] EF only in 00/01

Results and conclusions In rainfed conditions, the seed yield of the wettest year (2000/01) was about three times that of the driest year (1999/00), confirming how greatly the amount of rainfall during the crop cycle can influence crop productivity. Compared to rainfed crop, in both trial years, water addition of soon after herbage removal resulted in an increase in vegetative growth, but did not influence the reproductive phase (Table 1). So, significant increases in total above-ground biomass, but

not in seed production, were observed. However, the addition of the same limited amount of water at a later stage of growth, i.e. the early bud stage, prompted significant increases in both seed yield (+29 and +25%, respectively, over two years) and total biomass (+42 and +18%). Delaying irrigation further, i.e. at the first open flower, (applied only in 2000/01 season) led to the highest seed yield, and a significant increase of about 36 and 9%, compared to the non-irrigated control and irrigation at early bud, respectively. Multiple irrigations (2I and IC), compared to the single irrigation treatment at early bud, in 1999/00 had no effect on seed yield but resulted in greater vegetative growth only, whereas in 2000/01 caused a significant decrease of seed yield. Seed quality parameters (germination, MTG, hardness) were not affected by irrigation treatment. Overall, the research showed the possibility of increased seed production of berseem clover in semi-arid Mediterranean environments by merely applying a very limited amount of water (40 mm). Further research to investigate supplemental irrigation at even later growth stages and/or greater quantities of water is needed.

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References

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