Applied nitrogen and water use efficiency of rapeseed

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Oilseed rape is very responsive to moisture supply and also nitrogen (N) (1). Because N increases plant size and leaf area in rapeseed (1), it could be expected that more water is used by the plant when N is applied. The objective of this study was to determine if N enables rapeseed to extract more water, or alters the water use efficiency (WUE) of the crop.

Methods

Two experiments were established on a grey clay at Dooen, Victoria. The fallow site was cultivated for 10 months before sowing and the non-fallow site was in crop to wheat during 1987. Total soil moisture (TSM) to 150cm and available nitrate to 50cm were measured before sowing. Four replicates of 0 and 210 kg N/ha as ammonium nitrate were drilled in at sowing. Rapeseed cv. Taparoo was sown on July 5, 1988. Harvests were made at the start of flowering (FF) and at maturity (M). Two soil moisture cores per plot were taken to 150cm at FF and to 200cm at M. Rainfall from sowing to the commencement of flowering was about normal (125mm). Conditions were dry during flowering (47mm compared to an average of 74mm).

Results and discussion

Table 1 shows that the application of N resulted in the use of more water, and produced large biomass and seed yield increases, similar to other studies (1). WUE increased with applied N. Despite large differences in biomass at FF in response to N, neither site showed large differences in soil moisture content due to N. WUE for biomass and grain production with applied N are at lower end of the range of values measured for wheat in this environment (2). These figures indicate the importance of adequate N supply on the effective use of water by rapeseed. Further work hopes to identify the true contribution of soil evaporation to the manipulation of WUE.

Table 1. Characteristics for the sites and the amount of water used (change in TSM plus rainfall), plant production and water use efficiencies as affected by N application.

	Non-Fallow Site			Fallow Site		
TSM at sowing to 150cm	804mm(53.6%v/v)			859mm(57.3%v/v)		
Av. Nitrate to 50cm	84kg N/ha			120kg N/ha		
	0N	210N	LSD(P=5%)	0N	210N	LSD(P=5%)
Total Water Used(mm)	432	460	(24.8)	446	505	(15.5)
DM at maturity(t/ha)	5.24	9.52	(1.07)	4.99	10.13	(1.42)
Seed Yield(t/ha)	1.61	2.81	(0.33)	1.45	3.17	(0.41)
WUE biomass(kg/ha/mm)	12.1	20.7	(2.60)	11.2	20.2	(3.31)
WUE seed(kg/ha/mm)	3.75	6.11	(0.78)	3.24	6.04	(0.93)
Harvest index	0.31	0.29	(0.03)	0.29	0.30	(0.03)

1. Wright, G.C., C.J. Smith and M.R. Woodroofe (1988). Irrig. Sci.9, 1-13.

2. O'Leary, G.J., D.J. Connor and D.H. White (1985). Aust. J. Agric. Res. 36, 187-196.