'AN AGRONOMIC EVALUATION OF SUNFLOWER (*Helianthus annuus* L.) IN A MEDITERRANEAN-TYPE ENVIRONMENT'

A thesis submitted by;

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SUMMARY

This thesis summarizes studies on several of the agronomic problems which occurred when sunflower was evaluated as an oilseed crop in the Mediterranean-type climate of the South East of South Australia. Four agronomic experiments were undertaken in the period 1974 - 1981.

In Experiment 1 the effects of row spacing and plant population on yield and yield components of irrigated sunflower were investigated.

An established plant population of 6 plants m^{-2} was found to be a safe minimum density for maximum seed yield , while it was concluded that row spacing should be no wider than 45 cm except where mechanical weed control was necessary. Increased plant population significantly decreased sunflower head diameter and seed weight but had small and variable effects on seed oil content. Varying row spacing had no effect on head diameter, seed weight or seed oil content.

In Experiment 2 the effects of sowing date on sunflower phenology, yield and yield components were investigated. Early-sown sunflower took up to 30 days to emerge while later sowings emerged in 8 days. The period from sowing to 50 per cent first anthesis decreased from 105 days for Issanka and 121 days for Peredovik to 66 days for Issanka and 76 days for Peredovik from the first to the last sowings respectively. Response of both cultivars to photoperiod was found to be short day or day neutral and simple heat sum models were derived to predict the major phenological event of 50 per cent flowering. These models were validated using independent test sowings. For Issanka 947.7 $\pm$ 28.5 Growing Degree Days (G.D.D.) (Base 3.8^{0}C) were required from sowing to 50 per cent flowering and for Peredovik 961.0 $\pm$ 41.5 G.D.D. (Base 5.2^{0}C) were required from sowing to 50 per cent flowering. Highest seed yields occurred with August and

September sowings and seed yield decreased significantly with October and November sowings. Plant height, seed weight, oil content and oil yields per hectare significantly decreased with delay in sowing date but linoleic acid composition of the oil was little affected by sowing date because temperatures following flowering were similar for all sowings.

The objective of Experiment 3 was to determine the variability among 21 sunflower cultivars in rate of seedling emergence under cold conditions in the field. Minimum emergence time was 12 to 14 days after sowing and the earliest cultivars to achieve 50 per cent emergence were Suncross 51, Sungold, Siroleo and Issanka, while other cultivars took up to 6 days longer to reach 50 per cent emergence. Whether variation between cultivars for rate of emergence at low temperature is under genetic control per se or affected by linoleic acid level in the sown seed is yet to be determined. Wide variation (29 days) between sunflower cultivars occurred for the number of days from sowing to 50 per cent flowering, possibly due to different responses to photoperiod, while rate of emergence and time to flowering were independent. Cultivars which emerged most rapidly, flowered early and yielded well were Issanka, Siroleo, Suncross 51 and Experimental 350.

In Experiment 4 the adaptation of a range of sunflower cultivars to the South East of South Australia was evaluated over a range of environments and years using modified joint regression techniques.

When sown between mid October and early December, later-flowering cultivars were better adapted to the South East of South Australia because they produced significantly higher seed yields and oil content than earlier-flowering cultivars. For every day that flowering of a cultivar was later or earlier than Peredovik mean seed

yields increased or decreased by 56.6 kg ha^{-1} and mean oil content increased or decreased by 0.39 per cent. Of the cultivars which were tested at enough sites to allow analysis by modified joint regression, highest mean seed yields were produced by Hysun 31, Sungold, Suncross 52, Sunking and Hysun 30 which produced 16.4, 15.4, 14.7, 12.4 and 7.4 per cent more seed respectively than Peredovik. Of the highest yielding cultivars highest mean oil contents were produced by Suncross 52 (48.6%) and Hysun 31 (48.3%) while Hysun 30 (46.6%) and Sungold (45.5%) produced lower oil contents.

DECLARATION

This thesis contains no material which has been accepted for the award of any other degree or diploma in any University, and to the best of the author's knowledge and belief, the thesis contains no material previously published or written by another person, except when due reference is made in the text of the thesis.

TRENT D. POTTER

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