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THE EFFECTS OF PLANT COMPETITION ON VEGETATIVE AND
REPRODUCTIVE GROWTH IN SOYBEAN [Glycine max (L.) Merrill]
WITH PARTICULAR REFERENCE TO REPRODUCTIVE ABORTION

A thesis persented in partial fulfilment
of the requirement for the
Degree of Doctor of Philosophy
in Seed Technology
at Massey University
Palmerston North
New Zealand

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1988

ABSTRACT

This thesis reports the results of three complementary studies in which the growth pattern of soybean cultivars Matara (semideterminate) and Amsoy (indeterminate) were compared. The first trial studied the effects of interplant competition on soybean plant growth with particular emphasis on reproductive development. A Nelder's radial spacing design (type 1a) was used which provided plant densities ranging from 5.8 up to 61.2 plants.m⁻². The second study involved a histological and morphological study of glasshouse grown soybean flowers and field grown soybean pod samples to detect possible causes of floral and seed abortion. The third experiment determined the effect of intraplant competition on reproductive development using young leaf removal treatments with glasshouse grown soybeans.

Although interplant competition created by increasing plant density reduced vegetative growth and suppressed reproductive growth such as daily flower production, flowering period and total flower number per plant, it had no significant effect on the rate of reproductive abortion.

The semideterminate Matara showed less vegetative growth during the reproductive phase than Amsoy and produced about half the flowers in a flowering period which was on average 7 days shorter. However, Matara was capable of producing a similar seed yield to Amsoy at all densities. This was because Matara had significantly lower rates of reproductive abortion than Amsoy (average 65 vs 82%, respectively).

Neither problems in pollination nor lack of fertilization was found to be an important cause of flower abortion. It was found that 99 and 95% of the classifiable ovules in normal flowers of Matara and Amsoy, respectively, had been fertilized. Seed abortion within a pod occurred at every stage as a result of the curtailment of subsequent development, and was most frequent in the basal position.

Reproductive abortion in glasshouse grown soybean occurred at all

stages but was more pronounced at the flowering stage (68% for Matara and 71% for Amsoy). Young pod (≤ 2 -cm long) abortion was 9% for Matara and 11% for Amsoy, whereas large pod (>2 -cm long) was less than 1% in both cultivars.

Mechanical manipulation to reduce intraplant competition by young leaf removal (YLR) proved that competition between vegetative and reproductive growth certainly existed. In Amsoy YLR diverted assimilate flow into reproductive growth, especially at the R3 growth stage. YLR by 50% starting at growth stage R3 increased flower and pod numbers per plant both by 44% in Amsoy, but did not significantly increase seed yield. However, YLR in Matara, which showed a less plastic pattern of growth, caused detrimental effects, especially with 100% YLR at growth stages R1 and R3 which significantly reduced seed yields. In this experiment, YLR did not change the rate of combined reproductive abortion in either variety.

The consistency of rate of total combined reproductive abortion in both field grown and glasshouse grown soybeans, regardless of large differences in inter- and intraplant competition suggests that reproductive abortion in soybean is under genetic control, possibly through hormone action. A model for explaining assimilate flow in reproductive development as affected by YLR is discussed and emphasizes the likelihood of a role for hormones in this process. Suggestions are made for future work in this area based on the detailed understanding of the reproductive morphology of these two cultivars which has been gained from this study.

SEED APPEARANCE (100 SEEDS) FROM 6 HARVESTING TIMES
(DAYS AFTER PEAK FLOWERING, DAPF),
SHOWING RELATIVE SEED SIZE AND THE SIGNIFICANCE OF SEED ABORTION
OCCURRING AT THE BASAL POSITION OF THREE-SEEDED PODS
IN MATARA SOYBEAN

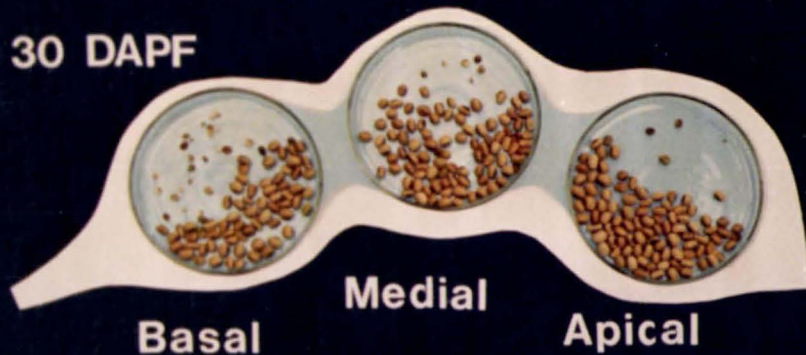
10 DAPF



20 DAPF



30 DAPF



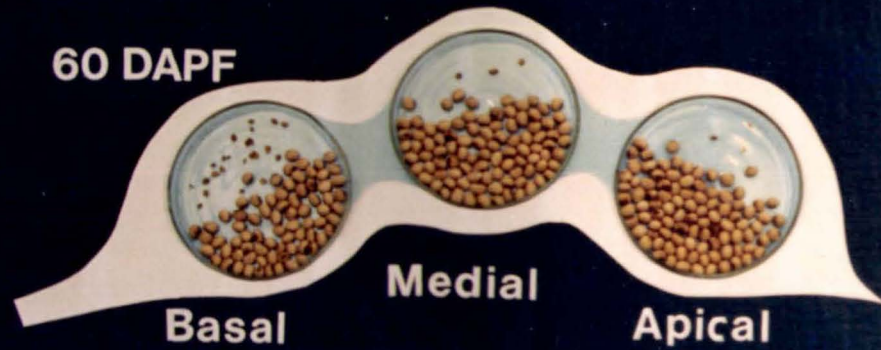
40 DAPF



50 DAPF



60 DAPF



ACKNOWLEDGEMENT

I wish to express my heartfelt gratitude to Dr. Murray J. Hill, my chief supervisor and Director of the Seed Technology Centre, for his wise supervision, constructive criticisms and understanding.

I am also greatly indebted to Dr. Peter Coolbear, my co-supervisor for his warm encouragement, constructive criticisms and patience in discussing and reading my manuscripts.

My sincere thanks are also extended to :

Professor R. G. Thomas for his guidance concerning cytological techniques.

Dr. J. G. Hampton for reading and contributing valuable comments on my manuscript of the field study.

Mr. Angus Robertson for his help in preparing the Rhizobium culture for the field study.

Mrs. D. E. M. Meech, Mr. C. R. Johnstone, Mrs. K. A. Johnstone, Mr. D. Pegler, Mr. C. R. McGill, Mrs. A. M. Davies and Mrs. D. Humphrey and also the staff of the Botany department for their help in so many ways.

The New Zealand Government for providing my scholarship, the Thai Government for allowing me to study in New Zealand and the Helen E. Akers Scholarships for financial support.

All my friends for their help and encouragement.

Mrs. G. Eustace for her suggestions and kindness in providing us with a real home in New Zealand. Mrs. Sirilak Sinthawalai for her encouragement, suggestions and moral support.

Finally, I would like to express my deep gratitude to my parents, whose love, support and encouragement has been invaluable to me. I also wish to thank my wife, Siree, most sincerely for her devoted support and for being by my side throughout this course of study.

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