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Plate 1. *Cucurbita maxima* in the field.



Plate 2. *Cucurbita maxima*, male and female flowers.

RESPONSES OF *Cucurbita pepo*  
AND *Cucurbita maxima* TO ETHREL

BY

R.J. HUME

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### Abstract

Many commercial crops of *Cucurbita maxima* and *C. pepo* are grown from F1 hybrid seed in New Zealand. Conventional methods of F1 seed production are labour intensive and expensive. Applying Ethrel sprays at 300ppm at the two and four leaf stage to the seed bearing parent delayed male flowering for sufficient time to allow insect pollination and eliminate 90% of the labour previously needed. After field trials the technique was used on a commercial scale. A satisfactory yield of pure F1 seed with a high germination percentage was produced.

The variation between cultivars in response to Ethrel means that each one must be tested. It is shown that the degree and type of epinasty of pot plants sprayed with Ethrel can be used to determine the appropriate concentrations for field trials of *C. pepo*.

The increase in female flower numbers, the shift in position of these flowers on the mainstem and the suppression of male flower numbers is brought about by two mechanisms. Ethrel sprays caused male flower bud abortion and an increase in the number of female flowers developing. More than one flower bud is borne in each leaf axil and if male, the bud aborts and can be replaced by a subsidiary undifferentiated bud which develops as a female. At the two to four leaf stage of plant development and shortly afterwards a large number of flower buds are developing to the stage of sexual differentiation. Spraying with Ethrel at these times is very effective in influencing sex expression. The release of ethylene by Ethrel breakdown continues for several days and the continuous exposure to ethylene is another reason for Ethrel's effectiveness.

The time course of ethylene release from aqueous Ethrel solutions was determined in some physical systems as well as from cotyledon and leaf surface contact. Some ethylene was released when Ethrel was applied to soil. When Ethrel was dried on surfaces or in soil its breakdown was much reduced, but on rewetting proceeded again.

Spraying only one leaf with Ethrel still caused responses from other parts of the plant indicating transmission of a stimulus. This was not caused by aerial diffusion from the sprayed leaf. Although several effects of ethylene were studied major emphasis was placed on epinasty, stimulation of endogenous ethylene and its distribution between plant parts, the abortion of male flowers and the induction of female flowers.

When aminoethoxyvinylglycine (AVG) was applied with Ethrel, the plants showed epinastic responses and male flower abortion but not female flower induction, endogenous ethylene production or transfer of stimuli of Ethrel effects within the plant. Ethylene gas was similarly ineffective on plants treated with AVG. Ethylene biosynthesis is blocked at the stage producing aminocyclopropane-1-carboxylic acid (ACC) the immediate precursor of ethylene. Assays showed ACC to be below detectable levels in AVG treated plants. Ethrel alone caused high levels of ACC and ACC was found in high levels in plant apices if leaf one was sprayed with Ethrel. ACC is mobile in plants and a firm correlation is shown between female flower bud production and the presence of ACC.

It was concluded the ethylene released from Ethrel sprays caused epinasty and male flower bud abortion as well as promoting endogenous ethylene production via ACC. Ethrel sprays release ethylene in sufficient quantity for long enough for very high levels of ACC to be produced and ACC is transported throughout the plant, but preferentially to metabolic sinks, eg. the plant apices, where embryonic buds respond by developing as female flower buds. Increased ethylene levels were also recorded at these sites.

Because ACC has been shown to cause a plant response formerly attributed to ethylene it is now essential to investigate the whole spectrum of 'ethylene' effects in plants.

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