ADVISORY COMMITTEE ON RELEASES TO THE ENVIRONMENT

Advice on separation distances for the cultivation of T25 maize

24 April 2003

Background

ACRE were asked to clarify their response to the evidence presented to the Chardon LL hearing by Professor Jean Emberlin regarding appropriate separation distances for the cultivation of GM maize containing the transformation event T25. Professor Emberlin's evidence is summarised in paragraphs 8.20.4- 8.20.20 of the Alesbury report of the hearing[1]. ACRE's overall response to the evidence presented at the hearing was published on 13 December 2002[2].

In her evidence, Professor Emberlin suggested that the separation distances used for GM maize were not adequate to ensure that GM presence in fields of non-GM maize was below the stated values. Specifically, the summary of her evidence states:

> '*…the SCIMAC Guidelines would allow Chardon LL to be grown at a distance of 200 metres from non-GM sweetcorn and seed crops, and organic maize crops of all kinds. Yet two of the studies discussed by Professor Emberlin had recorded pollen concentrations or percentage cross-pollination at 200 metres at levels in excess of 1%. The evidence indicates that at the SCIMAC separation distance of 200 metres cross pollination above 1% is likely, and increased levels are probable under favourable conditions.*' Paragraph 8.20.12

Professor Emberlin cites the study by Jones and Brooks (1950)[3] in support of this assertion. The separation distances recommended in the SCIMAC code[4] are based on an analysis of the relevant literature published by NIAB in August 2000[5].

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[1] Available at: http://www.defra.gov.uk/planth/pvs/chardon/rep01.htm
[2] Available at: http://www.defra.gov.uk/environment/acre/advice/advice20.htm
[3] Jones, MD, Brooks JS (1950) Effectiveness of distance and border rows in preventing outcrossing in corn. *Oklahoma Agricultural Experimental Station, Technical Bulletin No. T-38*
[4] Supply Chain Initiative on Modified Agricultural Crops guidelines for growing herbicide tolerant crops in the UK.
[5] Report on the separation distances required to ensure cross-pollination is below specified limits in non-seed crops of sugar beet, maize and oilseed rape. J. Ingram. National Institute of Agricultural Botany. 3 August 2000

ACRE's advice:

ACRE continues to consider that the separation distances for GM maize recommended in the SCIMAC code are sufficient to achieve the stated aim of less than 1% GM presence in adjacent fields of non-GM maize, as set out in advice issued to the National Assembly for Wales in May 2001[6].

Consideration

The thrust of Professor Emberlin's argument is that Jones and Brooks (1950)[3] measured, for maize, a mean frequency of hybrid seed formation at 200m of 1.19% over a three-year experiment. In contrast, the NIAB report[5] on which the SCIMAC separation distances are based cites an upper limit of GM presence in an adjacent non-GM maize field separated by 200m of 0.5% for a grain crop, and less than 0.25% for a silage crop.

ACRE accepts Professor Emberlin's analysis of the study by Jones and Brooks (1950), and is also content that the data reported by these authors accurately estimate the frequency of hybrid formation between separated maize crops under the conditions of the experiment. However, the Committee does not consider that the data of Jones and Brooks (1950) are incompatible with the separation distances reported in the NIAB report. Indeed, the data of Jones and Brooks (1950) were the primary source material used to determine the separation distances for maize proposed in the NIAB report.

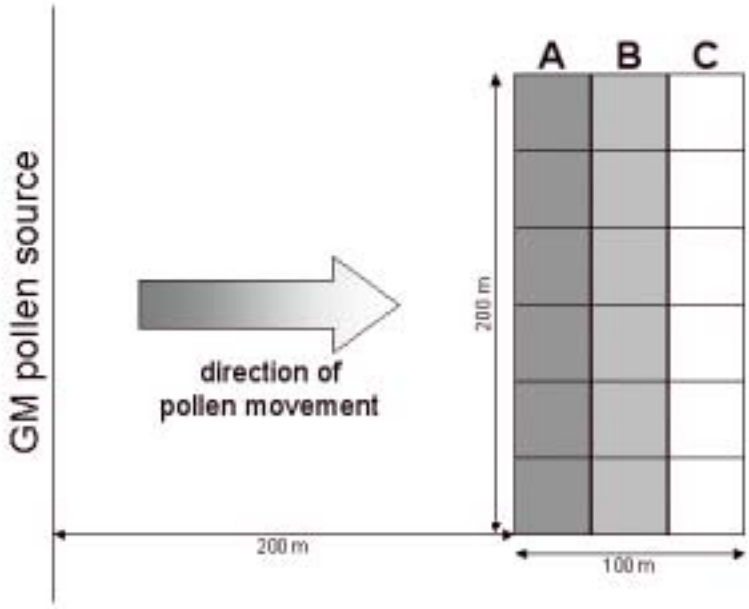
The apparent inconsistency between the data of Jones and Brooks (1950) and the NIAB report arises because of the way information is presented. In the Jones and Brooks study the frequencies of hybrid formation are measured as the proportion of hybrid grain harvested from a 100 ft square plot (0.09 Ha), that is separated from the pollen source by a specified distance. Because the grain from the plot was pooled prior to counting the number of hybrids present, this figure represents an average frequency of hybrid formation across the plot. It is well established that pollination frequency declines with distance, so that plants on the edge of the plot closest to the pollen source are likely to have had a greater number of hybrid grains than those further away. Cobs on maize plants at the edge of the 0.09 Ha plots will have a higher proportion of hybrid grain than those averaged across the whole plot.

The NIAB report used the data of Jones and Brooks to calculate the total GM presence averaged across a larger area of 2 Ha. While the 0.09 Ha portions of this larger area that are closest to the GM pollen source will have an average GM presence equivalent to that reported by Jones and Brooks, 0.09 Ha portions that are further away will have a lower GM presence, so that the average calculated over the whole 2 Ha area is lower than the Jones and Brooks figure. Calculation over the 2 Ha area is relevant, because it represents the GM presence in material harvested from a whole field separated from the GM crop by the specified distance. In fact most fields are greater in area that 2 Ha, so in most cases the average GM presence in the

[6] Available at: http://www.defra.gov.uk/environment/acre/advice/advice12.htm

material harvested will be much *lower* than that reported in the NIAB report – the larger the field the more the GM presence is 'diluted' by non-GM maize. However, it is the case that cobs from individual plants at the edge of the field nearest to the source of GM pollen will have a higher GM content than the average for the whole field. As a result, with a separation distance of 200m, individuals cobs from the edge of a non-GM maize field that is closest to the GM field may have a GM content that is higher than 0.5%. The Committee does not consider that this poses a risk to human health or the environment.

The situation is illustrated in the following diagram. The large rectangle represents the area over which the NIAB GM presence is calculated (100m x 200m = 2Ha), while the small squares are approximately the size of the sampling areas used by Jones and Brooks (1950). Based on the data of Jones and Brooks (1950) the squares in column A contain approximately 1.2% grain with GM presence, while the squares in columns B and C contain less than 1.2% grain with GM presence. The percentage of GM grain in columns B and C was estimated from the data of Jones and Brooks (1950). The overall average for all 18 small squares (the whole 2 Ha area) is 0.5% of grain containing GM presence.



The considerations discussed above also explain why the NIAB report recommends different separation distances for seed and forage maize crops. As a result of cross pollination, only the seeds on the cobs of the non-GM maize will contain a GM presence. As grain accounts for no more than 50% of the total weight of crop harvested for forage, at a given separation distance the GM presence in forage is less than the GM presence in grain. In this case, the GM presence is 'diluted' by the non-GM stem and leaf tissue of the plants.