

Outcrossing in Australian faba bean is less than expected

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Abstract

Faba bean is a partially outcrossing species. An isolation distance is needed to maintain genetic purity when more than one variety is grown in the field conditions. This information is crucial for seed growers and faba bean breeders. A study was conducted at the University of Sydney's Plant Breeding Institute, Narrabri over two years to examine the extent of natural outcrossing using the pure white flower characteristic as a morphological marker, which is controlled by a homozygous single recessive gene. The white flower genotype (IX225c) was grown in a paired row of 150 m long in four directions from a central 480 m² plot of normal flower genotype PBA Warda. Two bee-hives were placed in the central plot at flowering time and natural pollination was allowed. At maturity, seed samples were taken from the white flower genotype at designated intervals and 100 seeds from each sample were grown in the glasshouse/birdcage to the 4-5 leaf stage and the proportion of plants displaying the stipule spot pigmentation was used to determine the percentage of outcrossing (white flower and colourless stipule are linked in this genotype).

Maximum outcrossing of 2.5% occurred where both genotypes were grown side by side (0 m) and the degree of outcrossing decreased as the distance from the central plot increased. At 6 m distance the outcrossing was less than 1%, however it increased randomly reaching about 1% even at 130 m distance. This is probably an indication of random nature of bee flights. Directions, years and their interaction had no effect and the distance alone was the contributing factor indicating wind had no effect on the faba bean pollination. Because there was only about 0.3% outcrossing at the maximum distance of 150 m, it can be concluded that the safest isolation distance for maintaining genetic purity should not be more than 200 m. Maximum outcrossing of 2.5% suggested that honey bees do not take long flights while foraging among faba bean plants and/or Australian faba bean genotypes are almost self-fertile, and a narrow isolation distance would be enough while handling many genotypes in faba bean breeding programs.