THE EFFECTS AND IMPLICATIONS OF THE DWARF LETHAL (DL) GENES ON THE PROGRESS OF THE CHARACTER IMPROVEMENT PROGRAMME IN DRY BEANS (PHASEOLUS VULGARIS L.) IN ZAMBIA.

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The cultivated common bean Phaseolus vulgaris L. has been identified to have two centres of domestication either one having a distinct gene pool with its own Genic balance: The Meso-American and Andean Centres (1,2). Two distinct genes were identified from beans belonging to either centre. The Dwarf Lethal 1 (DL1) is found in the small-seeded beans from the Meso-American centre and Dwarf Lethal 2 (DL2) in the large-seeded ones from the Andean region (5). Crosses made between beans from these centres produce genetic incorpartibilities and dwarf lethals in the F1 which become stunted and chlorotic and most often die. Those that survive produce significantly lower than the heterotic hybrids.

Reports of the difficulty and subsequent limitation on the progress of bean breeding programmes resulting from an attempt to merge the two gene pools have been made by Kelly (2).

The recently revitalised Zambian bean improvement programme has involved the genetic study of disease and insect pest resistance and the incorporation of favourable genetic factors into the adapted and consumer preferred multi-coloured and large-seeded local landraces (3,4). Most if not all the favourable genetic sources available are the small-seeded DL1 carrier CIAT introductions from the Meso-American centre. The target genotypes for improvement are the Andean types and carry DL2 genes. The genetic incorpartibilities based on the percentage of successful crosses made between the two seed classes (data not shown) and lethality in F1 were dramatic, Table 1. Carioca is the current small-seeded standard variety and, besides its good but unstable yield (stability analysis results to be published elsewhere), it is resistant to scab (Elsinoe phaseoli Jenkins), anthracnose (Colletotrichum lindemuthianum (Sacc and Mang.) Scrib), angular leaf spot (Phaeo-isariopsis griseola (Sacc.) Ferrais) and rust (Uromyces phaseoli (Reben wint.). A74 is also small-seeded and carries resistance factors to some of the above major diseases and also has tolerance to beanfly infestations. IVT 7214 carries the recessive bc-3 gene which confers immunity to all known strains of bean common mosaic virus.

The dilemma of small-seeded bean genotypes in Zambia is chiefly based on established facts that large sections of the Zambian population do not readily accept such bean types either for consumption or commercial purposes. Slightly over seven years of human and monetary efforts trying to popularise them has not been very successful. People prefer their own unimproved and comparatively low yielding large-seeded types. The present work further identifies the limitation of using these small-seeded genotypes in an improvemnt programme geared towards the improvement of large-seeded genotypes. Although a smaller percentage of successful recombinants may be

obtained in crosses involving the two seed classes, pursuant of such efforts for a program that is growing fast and in a hurry for tangible results are a significant waste of time, money and human resources.

These findings should, therefore, help us define the orientation of the Zambian bean programme as follows:

1. Unless it is strictly for academic purposes, of which we are presently not that much concerned about due to resource limitations, introductions of small-seeded bean genotypes should not be officially encouraged. They will not be very useful both for consumption and commercial purposes.

2. Efforts for identifying genetic sources either for resistance to diseases or insect pests should be directed towards evaluating large-seeded genotypes, both from imported and local materials. The identification of such sources will not only be beneficial to the Zambian Character Improvement Programme but also a considerable probability exists that some of them may be recommended for release as varieties for commercial production. This, ofcourse, recognises the fact that our participation in regional and specific international trials which also include small-seeded genotypes will continue.

Table 1. The effect of merging the small and large-seeded bean genotypes on the production of F1 heterozygotes.

CROSS MADE	NO. OF F1 SEEDS PRODUCED	NO. OF F1 PLANTS DEVELOPING LETHALITY	% RECOMBINANT PLANT LOSS
Carioca (small) x ZPV 1315 (large)	5	5	100
ZPV 292 (large) x Carioca (small)	4	4	100
Carioca (small) x ZPV 292 (large)	28	22	79
A74 (small) x ZPV 292 (large)	2	2	100
IVT 7214 (small) x ZPV_292_(large)	3	3	100

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