BREEDING FOR COMMON BLIGHT RESISTANCE IN DRY BEANS IN SOUTH AFRICA

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Introduction

Common bacterial blight is a major constraint limiting South African dry bean production. The disease is widespread and occurs in all the major commercial production areas. Improvement of cultivars, by introducing stable resistance, is therefore the main objective of the bacterial research program at the Agricultural Research Council-Grain Crops Institute (ARC-GCI), South Africa.

Material and Methods

XAN 159 and Wilk 2 were selected for backcross breeding to improve the resistance of Kranskop (speckled sugar bean) and Teebus (small white canning bean). These cultivars were selected on the basis of their commercial value. Crosses were made between the resistant donor (pollen) parents, (XAN 159 and Wilk2) and the recurrent susceptible parents (Kranskop and Teebus respectively). First trifoliolate leaves of plants from the F1-generation were inoculated with a bacterial suspension containing approximately 10^8 CFU/ml water, using the multiple needle puncture method (Andrus, 1948). Leaves were rated for infection 14 days after inoculation on a 1 to 9 scale with 1 being highly resistant and 9 being highly susceptible. Susceptible plants were discarded (plants rated 4-9) and resistant plants (rated 1-3) selected for backcrossing. Major emphasis was placed on testing leaf blight resistance. The process of backcrossing was continued until a total of five generations of backcrossing and testing was completed.

Segregating populations from backcrosses were evaluated in field trials at Potchefstroom during the growing season and in KwaZulu/Natal during winter. Teebus were planted throughout the plot as susceptible check and also served as spreader rows. First or second trifoliolate leaves of each plant were inoculated using the multiple needle method and this was followed by spray inoculating plants weekly using a backpack sprayer. Each plant was rated separately and single plant selections made. Spray inoculated canopies were evaluated periodically from when first symptoms appeared on the susceptible checks until the crop matured. Single plant progeny rows were inoculated and rated similarly. Single plant selections were made until single rows with uniform high levels of resistance could be selected. After extensive field evaluation homozygous lines were handed to the breeder and evaluated for yield and other agronomic traits.

In addition to phenotypic disease reaction, molecular markers were used during the latter stage of the study to confirm transfer of resistance to local cultivars. The markers, SU91 and BC420 (XAN 159 derived), were tested on resistant lines from segregating populations. SCAR marker SAP6, derived from a resistant line GN Nebr. Sel#27, was also included.

Results

Improvement of small white canning beans

Resistance from XAN 159 and Wilk 2 were successfully transferred to the cv. Teebus in two separate backcross programs. Both programs have progressed to the completion of BC5. Approximately 98% of Teebus has been recovered with the addition of CBB resistance genes. Final selections were made from the F5-progeny rows. Field selections of Teebus backcrosses judged to be homozygous for important properties were tested for canning quality. The best lines
will be evaluated in yield trials in four different localities for 2 consecutive years. Successful lines will be entered in the National Cultivar Trials and seed be made available to farmers.

**Improvement of large seeded red speckled sugar beans**

Progress in improvement of CBB resistance in Kranskop, has had limited success. Resistance was successfully transferred from both XAN 159 and Wilk2. Only moderate levels of resistance were, however, observed in lines with acceptable seed color. Crosses were made between Kranskop and Vax 4. High levels of resistance were identified in F1 progeny and first backcrosses were completed. Some of the progeny from BC1 to BC3 that have been selected in the field as offshoots of the backcrossing program exhibit excellent desirable properties such as high yield and disease resistance, but are not suitable for use as such, having a seed color not acceptable for the market. Some of these lines might be acceptable in other African countries where a greater variety of seed types are planted. These lines were distributed to the SABRN and ECABREN networks for evaluation.

Both markers SU91 and BC420 (XAN 159 derived) as well as marker SAP 6 (GN Nebr. Sel. # 27) were successfully used to confirm resistance in selected lines. Marker SAP6 was present in Teebus and Kranskop and could have been introduced by parents used in developing these cultivars. Advanced Teebus lines developed through backcross breeding with XAN 159 had both SU91 and BC420 markers. Greenhouse results indicated that these lines had higher levels of resistance than XAN 159. This can be explained by the combined resistance from GN Nebr. #1 sel. 27 and XAN 159, present in these lines.

Both SU91 and BC420 markers are present in Wilk 2, 4 and 6 which indicates that resistance from XAN 159 (or the same source) was used in developing these lines. PCR studies from BC 5 lines derived from backcrosses between Wilk 2 and Teebus as recurrent parent indicated that both markers SU91 and BC420 (XAN 159 derived) were transferred to these lines.

XAN 159 derived Kranskop-lines only had moderate levels of resistance when tested in the greenhouse. PCR studies indicated that the BC420 marker was absent in these lines. This marker is near the V locus conditioning purple flower color (Miklas et al., 2000) resulting in resistant plants exhibiting seed unacceptable for the market. Presence of marker BC420 seems important to obtain high levels of resistance.

**References**
