pared to other cultivars grown at Pretoria, Bloemfontein, and Port Elizabeth, South Africa. In these trials, the bacterial wilt-resistant cultivar 'Rodade' outyielded 'Rotam 4' significantly in the 50- to 70-mm range (Table 1). The yield of 'Rotam 4' did not differ significantly from that of 'Flora-Dade' in the 50- to 70-mm range but was greater than that of 'Flora-Dade' in the >70-mm range. The plants in these field trials were relatively free

from the diseases and pests to which 'Rotam 4' is resistant.

Availability

'Rotam 4' is protected by Plant Breeders Rights. Requests for seed for breeding purposes may be directed to The Director, Vegetable and Ornamental Plant Research Institute, Private Bag X293, Pretoria, 0001, Republic of South Africa.

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HORTSCIENCE 25(10):1314-1315. 1990.

CU-M88: A Dry Black Bean Breeding Line Resistant to Bean Yellow Mosaic Virus

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Additional index words. By-2 gene, BYMV resistance, *Phaseolus vulgaris*, vegetable breeding

In North America, black beans (*Phaseolus vulgaris* L.) are produced primarily for the domestic and Latin American export markets. Currently, most of these cultivars are susceptible to bean yellow mosaic virus (BYMV), which causes one of the most destructive diseases of beans in New York and the adjacent Great Lakes region. Susceptible plants exhibit symptoms that include leaf malformation, yellow mosaic, and stunting (Dickson and Natti, 1968). The purpose of

this breeding program was to incorporate BYMV resistance into 'Midnight' (Sandsted, 1980), a standard black bean cultivar grown throughout the region. The source of resistance was the single dominant gene *By-2*, which was first transferred into *P. vulgaris* through an interspecific cross with an accession of scarlet runner bean (*P. coccineus* L.) (Dickson and Natti, 1968; Provvidenti, 1987). The name "CU-M88" denotes origin at Cornell Univ. (CU) with 'Midnight' as the recurrent parent (M), and 1988 as the year of selection. This breeding line is intended for use in Central and North American

breeding programs or wherever BYMV occurs.

Origin

The standard backcross procedure was used to develop CU-M88, with 'Midnight' as the recurrent female parent for five generations and B-21 as the donor parent providing the *By-2* gene (Fig. 1). B-21 is a black bean breeding line developed from a series of backcrosses that used 'Black Turtle-1' ('BT-1') as the recurrent parent and 'BL-6', the progeny of a *P. vulgaris* x *P. coccineus* interspecific cross, as the donor parent (Dick-

Fig. 1. Pedigree of CU-M88.

Received for publication 31 Oct. 1989. This research was supported by the Depts. of Vegetable Crops, Plant Breeding and Biometry, and Plant Pathology, Cornell, and USAID Title XII Bean/Cowpea CRSP. We gratefully acknowledge the assistance of D. Benscher, J.G. Doss, W.L. Hymes, and Ligia Montorossa-Teñas. We also thank A.W. Saettler for performing anthracnose inoculations. Plant Breeding and Biometry paper no. 789. The cost of publishing this paper was defrayed in part by the payment of page charges. Under postal regulations, this paper therefore must be hereby marked advertisement solely to indicate this fact.

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Table 1. Comparison of CU-M88 to 'Midnight' black bean at Freeville, N.Y., in 1988.

Trait	Mean $\pm$ SE		<i>t</i> ²	<i>P</i> _α
	CU-M88	Midnight		
Yield (t·ha ⁻¹)	6.53 $\pm$ 0.35	6.49 $\pm$ 0.31	0.07	0.94
Biomass ² (t·ha ⁻¹)	12.22 $\pm$ 0.44	12.82 $\pm$ 0.25	1.20	0.27
Harvest index (%)	53.4 $\pm$ 1.15	50.6 $\pm$ 1.66	1.37	0.22
Seed weight (g/100 seed)	21.9 $\pm$ 0.24	21.6 $\pm$ 0.13	1.17	0.28
Days to maturity	107.0 $\pm$ 2.0	105.5 $\pm$ 1.1	0.64	0.54

²Values computed on the assumption of equal variance.

²Air dry weight of defoliated aerial biomass.

Fig. 2. Plant and seed of CU-M88 and 'Midnight'.

son and Natti, 1968; Provvidenti, 1983; Provvidenti et al., 1989). CU-M88 was evaluated as M88-C and selected from an array of four candidate lines (M88-B, C, D, and F) in BC-4F₃ (Halseth and Hymes, 1989). In each backcross generation (BC-1 through BC-4), a minimum of 20 plants was mechanically inoculated with BYMV (isolate #1) (Hagedorn and Walker, 1950) at the primary leaf stage to identify progeny with the By-2 gene. Progeny tests for this gene were performed in BC-4F₂ and resistance confirmed in BC-4F₃. CU-M88 is derived from the progeny of the BC-4F₂.

Description

In the environment of northern New York, CU-M88 is an upright plant 40 to 60 cm in

height and rarely up to 90 cm. Plants are morphologically similar to 'Midnight', generally stiff-stemmed with an indeterminate growth habit (CIAT Type II) (Adams et al., 1985) and short runners (4–8 cm) that do not intertwine (Fig. 2). The stems have 12 to 16 main-stem nodes and are lightly suffused with purple. The flowers are purple and produce pods that are set high on the plant. Pods are 6 to 10 cm long, dry to a tan color, and contain five to seven seeds. Seed morphology is essentially the same as 'Midnight', with an average 100-seed weight of 22 g and a dull black surface, although CU-M88 seed occasionally develop transverse wrinkles. Time to maturity ranges from 100 to 110 days.

As with 'Midnight', CU-M88 appears to carry some tolerance to damping off (*Pyth-*

ium ultimum Trow.) and root rot [*Fusarium solani* (Mart.) Appel and Wr. f. sp. *phaseoli* (Burk), Snyd. and Hans.] (Sandsted, 1980). It is not resistant to white mold [*Sclerotinia sclerotiorum* (Lib.) de Bary] under field conditions, but may avoid serious infection because of its upright growth habit. CU-M88 carries resistance to the gamma race and partial resistance to the delta race of anthracnose [*Colletotrichum lindemuthianum* (Sacc. & Magn.) Briosi & Cav.]; however, it is susceptible to the alpha race (A.W. Saettler, personal communication). Additionally, CU-M88 is resistant to the U.S. 1 and N.Y. 15 strains of bean common mosaic virus. Because of the nature of the By-2 gene, BYMV-infected plants may develop systemic necrosis if daily mean temperatures exceed 30°C.

A preliminary comparison at Freeville, N.Y., in 1988 suggested no differences between 'Midnight' and CU-M88 for seed yield, biomass, harvest index, seed size, or days to maturity at $P_{\alpha} \leq 0.05$ (Table 1). The cooking and canning quality of this release is nearly equivalent to 'Midnight'. These data suggest that CU-M88 is comparable to 'Midnight' and may be suitable for final evaluation and release as a BYMV-resistant cultivar.

Availability

Small quantities of seed are freely available. Contact D.H.W.

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