

## Beta genetic resources: North American activities

Barbara Hellier<sup>1</sup> and Lee Panella<sup>2</sup>

<sup>1</sup> USDA-ARS NPGS Western Regional Plant Introduction Station (WRPIS), Pullman, WA, USA

<sup>2</sup> USDA-ARS Sugarbeet Research Unit, Crops Research Laboratory, Fort Collins, CO, USA

### Introduction and status of the collection

The U.S. National Plant Germplasm System's (NPGS) *Beta* collection is housed at the U.S. Department of Agriculture (USDA)-Agriculture Research Service (ARS) Western Regional Plant Introduction Station (WRPIS) in Pullman, Washington, USA. This collection has a total of 2521 accessions of both cultivated and wild species of beet. Table 1 is a summary of the current holdings and status of the collection. Over the last four years we have incorporated 141 new accessions. The majority of these accessions are *Beta vulgaris* subsp. *vulgaris* cultivars but we also received 21 accessions of *B. v.* subsp. *maritima*, 20 accessions of wild *Beta* from other institutions, and 20 accessions of wild collected *Beta nana* from the 2005 NPGS-sponsored mission to Greece (see Frese et al., this volume, pp. 45-52). From 2003 to 2006, we distributed a total of 1644 seed packets. Table 2 summarizes our distribution activities.

**Table 1.** Status of the U.S. *Beta* collection

| Taxon                                       | No. of accessions |           |           |
|---|-------------------|-----------|-----------|
|   | Total             | Available | Backed-up |
| <i>Beta corolliflora</i>                    | 4                 | 1         | 3         |
| <i>Beta</i> hybrid                          | 2                 | 1         | 1         |
| <i>Beta lomatogona</i>                      | 29                | 2         | 4         |
| <i>Beta macrocarpa</i>                      | 16                | 12        | 13        |
| <i>Beta macrorhiza</i>                      | 20                | 2         | 2         |
| <i>Beta nana</i>                            | 21                | 0         | 0         |
| <i>Beta patellaris</i>                      | 29                | 17        | 12        |
| <i>Beta patula</i>                          | 3                 | 2         | 3         |
| <i>Beta procumbens</i>                      | 15                | 6         | 5         |
| <i>Beta</i> sp.                             | 16                | 6         | 5         |
| <i>Beta trigyna</i>                         | 48                | 6         | 5         |
| <i>Beta vulgaris</i>                        | 21                | 9         | 16        |
| <i>Beta vulgaris</i> subsp. <i>maritima</i> | 571               | 445       | 391       |
| <i>Beta vulgaris</i> subsp. <i>vulgaris</i> | 1710              | 1276      | 1437      |
| <i>Beta webbiana</i>                        | 8                 | 0         | 1         |
| <i>Beta</i> x <i>intermedia</i>             | 8                 | 1         | 1         |

**Table 2.** Summary of distributions

| Year | No. of orders | No. of seed packets distributed |         |       |
|------|---------------|---------------------------------|---------|-------|
|      |               | U.S.                            | Foreign | Total |
| 2003 | 32            | 371                             | 109     | 480   |
| 2004 | 35            | 340                             | 38      | 378   |
| 2005 | 49            | 357                             | 96      | 453   |
| 2006 | 38            | 311                             | 22      | 333   |

Currently, 70.8% of the US *Beta* collection is available for distribution and 75.3% of the accessions have duplicate samples (back-up) at the USDA-ARS National Center for Genetic Resources Preservation (NCGRP) in Fort Collins, Colorado. Of the 1710 accessions of *B. v. subsp. vulgaris*, 74.6% are available and 84% have back-up samples deposited at NCGRP. The *B. v. subsp. maritima* collection is similarly available but with fewer accessions backed-up: 77.9% available, 68.5% backed-up. The majority of the accessions that are unavailable are the more difficult to germinate and regenerate wild *Beta* species.

To address the unavailability of the *Beta* species accessions we are currently focusing our regeneration efforts on this material along with *B. v. subsp. maritima*. At present, all our increases are done in the greenhouse. We use all available, suitable spaces in the WRPIS and Washington State University greenhouse systems, a total of 13-19 rooms.

Because there is still a considerable backlog of *Beta vulgaris* accessions we are again addressing field increase of this material. As reported previously (Panella et al. 2002) we have experimented with field increase and had some success in Pullman. Due to personnel changes in 2004 further experimentation and modifications to the field programme were temporarily stopped. We are once again looking at developing a field increase protocol. In autumn 2006, we planted four accessions in the field: three accessions of *B. v. subsp. vulgaris* and one accession of *B. v. subsp. maritima*. We are looking at cage size, testing two cage sizes to address heat and pest accumulation in the cages in the summer. We also are looking at fall versus spring planting in both *B. v. subsp. vulgaris* and *B. v. subsp. maritima* to address problems we have had in overwintering beet germplasm.

### Evaluation

Evaluation of the U.S. *Beta* collection is coordinated by the U.S. Sugarbeet Crop Germplasm Committee (see report in Part I, this volume, pp. 8-9). Since 1994, 20 to 30 accessions per year have been evaluated for resistance to the following diseases: rhizoctonia, cercospora, root maggot, curly top, and rhizomania. In addition to disease resistance evaluations, descriptor data are collected on accessions being regenerated. Data from all evaluations are entered into the Germplasm Resources Information Network (GRIN) and available on the Web at <http://www.ars-grin.gov/npgs/index.html>. These data are being used by public breeders in the United States to begin the long-term process of introgression of novel resistance genes into agriculturally acceptable sugar beet germplasm (Panella and Lewellen 2007).

**References**

- Panella L, Hannan R, Hodgdon A. 2002. *Beta* genetic resources: North American activities. In: Frese L, Germeier C, Lipman E, Maggioni L, compilers. Report of a Working Group on *Beta* and World *Beta* Network. Second joint Meeting, 23–26 October 2002, Bologna, Italy. International Plant Genetic Resources Institute, Rome, Italy. pp. 78-83.
- Panella L, Lewellen RT. 2007. Broadening the genetic base of sugar beet: introgression from wild relatives. *Euphytica* 154(3):383-400.