```
P5_1        CTTTTGATGAGCCCTTCTTTACATCACCCTCGCTTGCTCCATTACCTCCCACAGAAGCAC    60
P5_2        CTTTTGATGAACCCTTCTTTACATCACCCTCGCTTGCTCCATTACCTCTCACAGAAGCAC    60
P5_3        CTTTTGATGAACCCTTCTTTACATCACCCTCGCTTGCTCCATTACCTCTCACAGAAGCAC    60

P5_1        CCATTCCACAATGGGTACCTGGTAATGGTATCGCGGCACCACCATATCAGATTCATGGTT    120
P5_2        CCATTCCACAATGGGTACCTGGTAATGGTATCGCGGCACCACCATATCAGATTCATGGTT    120
P5_3        CCATTCCACAATGGGTACCTGGTAATGGTATCGCGGCACCACCATATCAGATTCATGGTT    120

P5_1        GTGGTTACCCATGTAACGACTCCAATGACTGTGATGCACCCTGTACAGTCTGTTGTGCAA    180
P5_2        GTGGTTACCCATGTAACGACTCCAATGACTGTGATGCACCCTGTACAGTCTGTTGTGCAA    180
P5_3        GTGGTTACCCATGTAACGACTCCAATGACTGTGATGCACCCTGTACAGTCTGTTGTGCAA    180

P5_1        ACTATACCTGCTGTTATGATGTGGCTGATCCTGAGTACATGCTACCACCTATGTCACCCT    240
P5_2        ACTATACCTGCTGTTATGATGTGGCTGATCCTGAGTACATGCTACCACCTATGTCACCCT    240
P5_3        ACTATACCTGCTGTTATGATGTGGCTGATCCTGAGTACATGCTACCACCTATGTCACCCT    240

P5_1        CTGAGCCACCGAAATTATTACCTCTTCCACCATCTCCACCTCCATCTACAGAGGATGTAG    300
P5_2        CTGAGCCACCGAAATTATTACCTCTTCCACCATCTCCACCTCCATCTACAGAGGATGTAG    300
P5_3        CTGAGCCACCGAAATTATTACCTCTTCCACCATCTCCACCTCCATCTACAGAGGATGTAG    300

P5_1        AAAATAAATGATATGTTTGCACCACAACCTGCTTATGATATAGGAACGCCTGCGGAACTTC    360
P5_2        AAAATGATGATATGTTTGCACCACAACCTGCTTATGATATAGGAACGCCTGCGGAACTTC    360
P5_3        AAAATGATGATATGTTTGCACCACAACCTGCTTATGATATAGGAACGCCTGCGGAACTTC    360

P5_1        CACCACCAGGATACGAATTCCCGCCATATCAAATCCATGGTTGTGGCTATGGCCCCTGCA    420
P5_2        CACCACCAGGATACGAATTCCCGCCGTATCAAATCCATGGTTGTGGCTATGGCCCCTGCA    420
P5_3        CACCACCAGGATACGAATTCCCGCCGTATCAAATCCATGGTTGTGGCTATGGCCCCTGCA    420

P5_1        TGGACTCCAACGACTGCGATTGGCCCTGCACATCCTGCTGCTCTAATCATACATGTTGCT    480
P5_2        TGGACTCCAACGACTGCGATTGGCCCTGCACATCCTGCTGCTCTAATCATACATGTTGCT    480
P5_3        TGGACTCCAACGACTGCGATTGGCCCTGCACATCCTGCTGCTCTAATCATACATGTTGCT    480

P5_1        ATGAGGAGCCTATGTTTCGATGAAAATCCTCAAACACACAAATTCCAAAGAAAAAGTATA    540
P5_2        ATGAGGAGCCTATGTTTCGATGAAAATCCTCAAACACACAAATTCCAAAGAAAAAGTATA    540
P5_3        ATGAGGAGCCTATGTTTCGATGAAAATCCTCAAACACACAAATTCCAAAGAAAAAGTATA    540

P5_1        GTAACACAATGTAATAAAACTTAGTGTTCCTGTATTACTTAAAATCACATTTGACCTATA    600
P5_2        GTAACACAATGTAATAAAACTTAGTGTTCCTGTATTACTTAAAATCACATTTGACCTATA    600
P5_3        GTAACACAATGTAATAAAACTTAGTGTTCCTGTATTACTTAAAATCACATTTGACCTATA    600

P5_1        TTCTTCAATTGCTATGTCATTGTCTAATGATTGAAAGCAAGTACTTTTATTTCTGTGTCA    660
P5_2        TTCTTCAATTGCTATGTCATTGTCTAATGATTGAAAGCAAGTACTTTTATTTCTGTGTCA    660
P5_3        TTCTTCAATTGCTATGTCATTGTCTAATGATTGAAAGCAAGTACTTTTATTTCTGTGTCA    660
```

```
P5_1        TACAAATGTAAGCAAGATCAATAAAGAATATATACAACTACGTTAATCAATTGCTACTAT    720
P5_2        TACAAATGTAAGCAAGATCAATAAAGAATATATACAACTACGTTAATCAATTGCTACTAT    720
P5_3        TACAAATGTAAGCAAGATCAATAAAGAATATATACAACTACGTTAATCAATTGCTACTAT    720

P5_1        CAAACTGCATTTTCTATCAAACAACAGTATAATTATTCTGACGTGCTCTAATAATTAAAG    780
P5_2        TAAACTGCATTTTCTATCAAACAACAGTATAATTATTCTGACGTACTCTAATAATTAAAG    780
P5_3        TAAACTGCATTTTCTATCAAACAACAGTATAATTATTCTGACGTACTCTAATAATTAAAG    780

P5_1        TGGGTTGAACTAAGCCTTTAATGACTGATTCATCTGCTCTACGCCTATATCACAATTTCA    840
P5_2        TGGGTTGAACTAAGCCTTTAATGACTGATTCATCTGCTCTACGCCTATATCACAATTTCA    840
P5_3        TGGGTTGAACTAAGCCTTTAATGACTGATTCATCTGCTCTACGCCTATATCACAATTTCA    840

P5_1        GAGTAGATACATTGCGAGATTTCTGCTGTAAGAACCATTTTGATCATGTTGCTGTTACAG    900
P5_2        GAGTAGATACATTGCGAGATTTCTGTTGTAAGAACCATTTTGATCATGTTGCTGTTACAG    900
P5_3        GAGTAGATACATTGCGAGATTTCTGTTGTAAGAACCATTTTGATCATGTTGCTGTTACAG    900

                                          934
P5_1        ACAACATGATTTTCAGTATATTTTGTTTACAAATTTCCTTCGTCGAGGAAATTCTGGCAT    960
P5_2        ACAACGTGATTTTCAGTATATTTTGTTTACAAACTTCCTTCGTCGAGGAAATTCTGGCAT    960
P5_3        ACAACGTGATTTTCAGTATATTTTGTTTACAAACTTCCTTCGTCGAGGAAATTCTGGCAT    960
                      ---------->
                      dCAPS-Fw

P5_1        GTATTATTAAGATACCAACTTAAATTCTGGTATAGGTTCCATTCTAATTAATATCATCGG    1020
P5_2        GTATTATTAAGATACCAACTTAAATTCTGGTATAGGTTCCATTCTAATTAATATCATCGG    1020
P5_3        GTATTATTAAGATACCAACTTAAATTCTGGTATAGGTTCCATTCTAATAAATATCATCGG    1020

P5_1        CATACTCCTCAACTTAGATTCATTCTTAGTTGATTTCACATCTTAATTCGTCAACTTTCA    1080
P5_2        CATACTCCTCAACTTAGATTCATTCTTAGTTGATTTCACATCTTAATTCGTCAACTTTCA    1080
P5_3        CATACTCCTCAACTTAGATTCATTCTTAGTTGATTTCACATCTTAATTCGTCAACTTTCA    1080

P5_1        TAGAGAACTCATCACAGGATAAGCCAGTTTAGTTCAACAATAGTATATTCCTCCGCCAAA    1140
P5_2        TAGAGAACTCATCACAGGATAAGCCAGTTTAGTTCAACAATAGTATATTCCTCCGCCAAA    1140
P5_3        TAGAGAACTCATCACAGGATAAGCCAGTTTAGTTCAACAATAGTATATTCCTCCGCCAAA    1140
                                                  <----------
                                                  dCAPS-Rv

P5_1        ATCCACATAATGTTTTGAGAGTTTTAATTGCAAGTGGTATACCATCATGCTTTTTCAGTT    1200
P5_2        ATCCACATAATGTTTTGAGAGTTTTAATTGCAAGTGGTATACCATCATGCTTTTTCAGTT    1200
P5_3        ATCCACATAATGTTTTGAGAGTTTTAATTGCAAGTGGTATACCATCATGCTTTTTCAGTT    1200
            ----------

P5_1        TTCACTTTCGATAAATCAAAATCAATATAAATCCTTTCCTCAAAAAGAAAAAACGATATA    1260
P5_2        TTCACTTTCGATAAATCAAAATCAATATAAATCCTTTCCTCAAAAAGAAAAAACGATATA    1260
P5_3        TTCACTTTCGATAAATCAAAATCAATATAAATCCTTTCCTCAAAAAGAAAAAACGATATA    1260

P5_1        AATCCTAGCTCCAATTCGTAAAAGAATTTTACCAAAGTACTTCCTCCGTTTCGTTTCAAA    1320
P5_2        AATCCTAGCTCCAATTCGTAAAAGAATTTTACCAAAGTACTTCCTCCGTTTCGTTTCAAA    1320
P5_3        AATCCTAGCTCCAATTCGTAAAAGAATTTTACCAAAGTACTTCCTCCGTTTCGTTTCAAA    1320
```

```
P5_1    TGCAACAAAAGGGTATTATTTGTGAGATATAAAATTTCCAATTGTTGCGTTTAAAACGAG   1380
P5_2    TGCAACAAAAGGGTATTATTTGTGAGATATAAAATTTCCAATTGTTGCGTTTAAAACGAG   1380
P5_3    TGCAACAAAAGGGTATTATTTGTGAGATATAAAATTTCCAATTGTTGCGTTTAAAACGAG   1380

P5_1    ATGGAGGAAGCATTAAAAGTTGTAAGACAACAAAATGAAAACAAATGGATAAATTTCATA   1440
P5_2    ATGGAGGAAGCATTAAAAGTTGTAAGACAACAAAATGAAAACAAATGGATAAATTTCATA   1440
P5_3    ATGGAGGAAGCATTAAAAGTTGTAAGACAACAAAATGAAAACAAATGGATAAATTTCATA   1440

P5_1    ATATATTCAACTCTACCTTCTTTTGCTCAACATCACATACACACATCCGCACCTGACAAT   1500
P5_2    ATATATTCAACTCTACCTTCTTTTGCTCAACATCACATACACACATCCGCACCTGACAAT   1500
P5_3    ATATATTCAACTCTACCTTCTTTTGCTCAACATCACATACACACATCCGCACCTGACAAT   1500

P5_1    CATTATTCATTAAAACACCCGATAAAATAAATACCAGTTCTGAAATCATGGATATGAAAC   1560
P5_2    CATTATTCATTAAAACACCCGATAAAATAAATACCAGTTCTGAAATCATGGATATGAAAC   1560
P5_3    CATTATTCATTAAAACACCCGATAAAATAAATACCAGTTCTGAAATCATGGATATGAAAC   1560

P5_1    TCACAGTAAAAAGAGTATAAAAAACACCAGCTGAAGCAAACACAAGATCAACAAAGAGGT   1620
P5_2    TCACAGTAAAAAGAGTATAAAAAACACCAGCTGAAGCAAACACAAGATCAACAAAGAGGT   1620
P5_3    TCACAGTAAAAAGAGTATAAAAAACACCAGCTGAAGCAAACACAAGATCAACAAAGAGGT   1620

P5_1    AAAAATCAAAAAATGGTCGTATCAAAATATTATTCTCTACT   1661
P5_2    AAAAATCAAAAAATGGTCGTATCAAAATATTATTCTCTACT   1661
P5_3    AAAAATCAAAAAATGGTCGTATCAAAATATTATTCTCTACT   1661
```

Fig. S1 Nucleotide sequences of s17 target region of garden beet genetic resources showing p5. Polymorphic sites are highlighted in green. The positions of dCAPS-Fw and dCAPS-Rv primers are indicated by arrows. PCR products obtained by using these primers have a HindIII site when they are amplified from P5_2 or P5_3 but not from P5_1. We refer P5_1 as p5A, and P5_2 and P5_3 as p5B.

‘**Differences in the frequency of restorer-of-fertility 1 haplotype are associated with crop history of garden beet and sugar beet (Beta vulgaris L.)**’

Molecular Breeding

Eigo Taniguchi [1, †], Yohei Kanomata [1, †], Haruto Tanaka [1, †], Mion Oishi [1], Ryo Hayakawa [1], Hiroaki Matsuhira [2], Tsubasa Narihiro [2], Yosuke Kuroda [2], Hiroyo Kagami-Katsuyama [3], Tomohiko Kubo [1], Kazuyoshi Kitazaki [1, *]

[1] Research Faculty of Agriculture, Hokkaido University, Sapporo, Japan

[2] Hokkaido Agricultural Research Center, National Agriculture and Food Research Organization, Memuro, Japan

[3] Department of Medical Management and Informatics, Hokkaido Information University, Ebetsu, Japan

[*] Corresponding author (kitazaki@agr.hokudai.ac.jp)