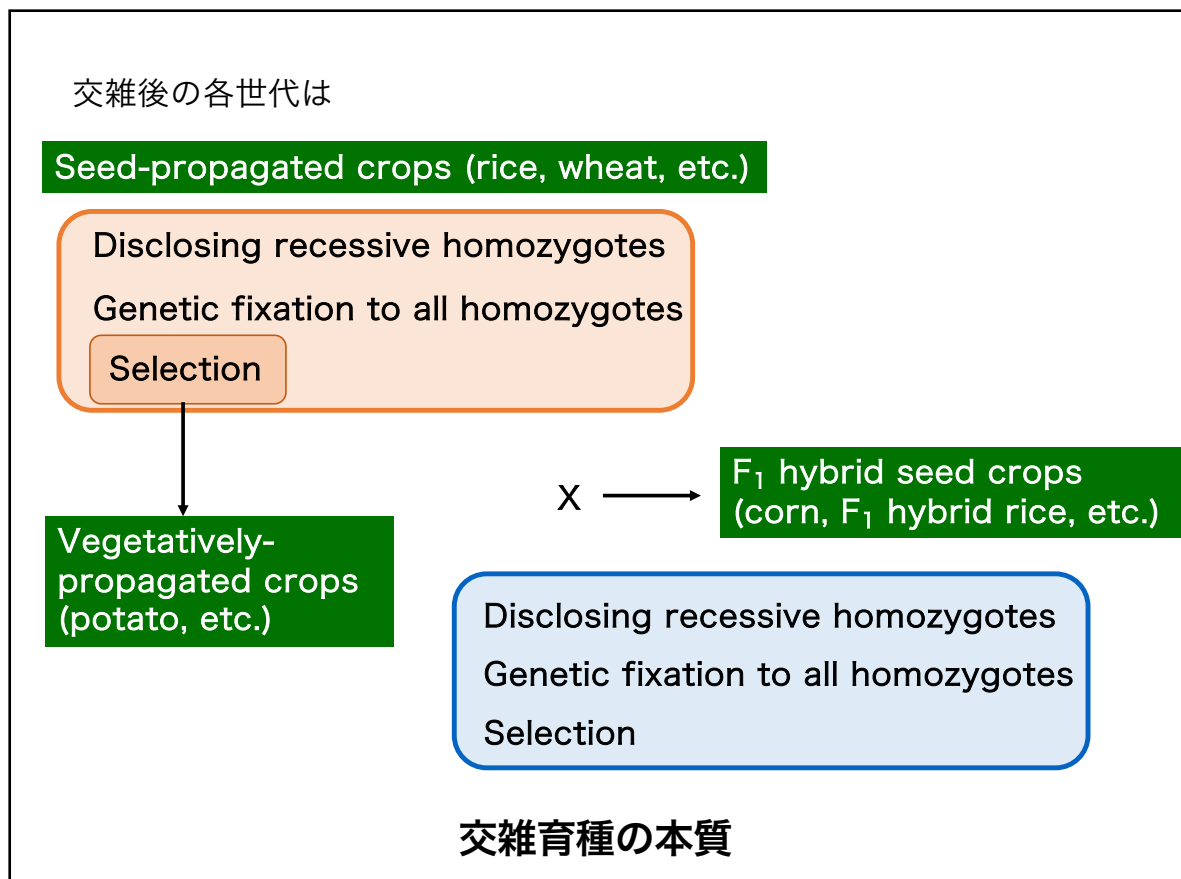
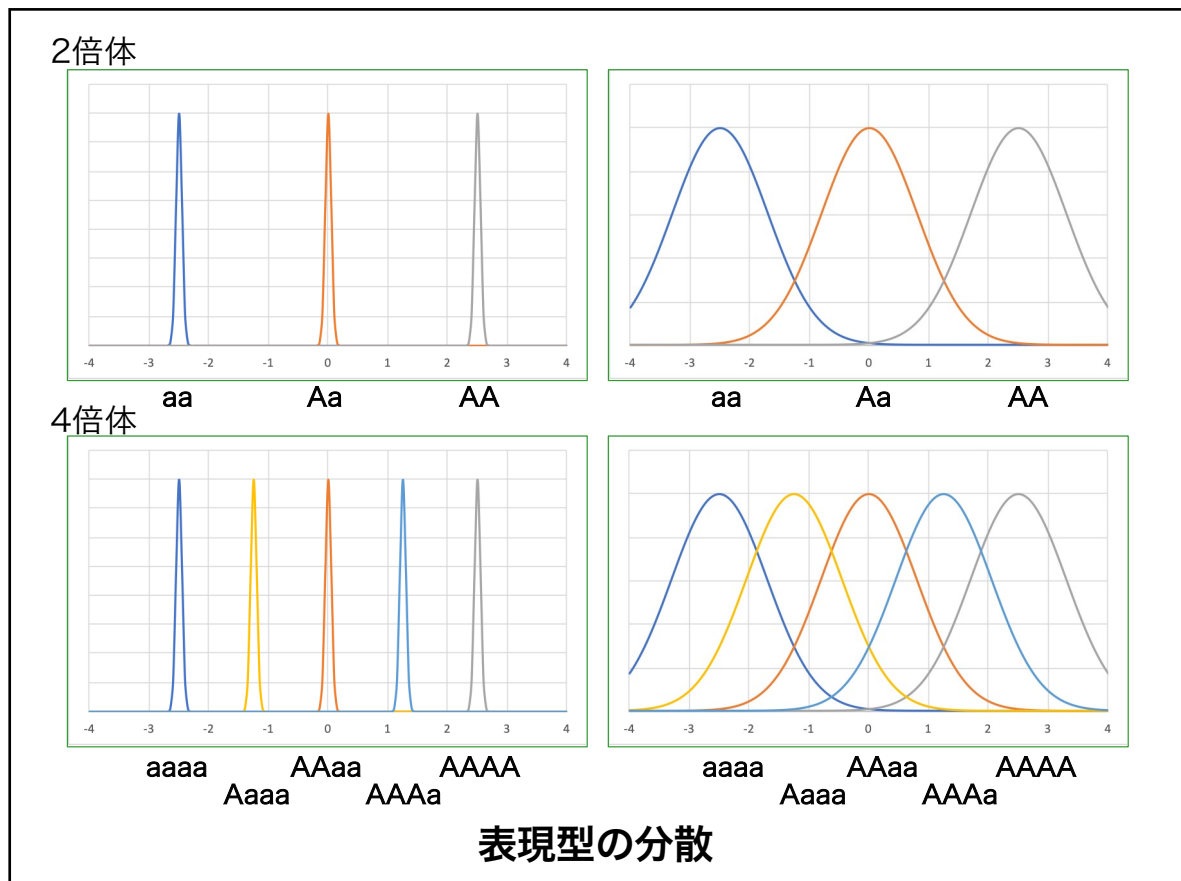




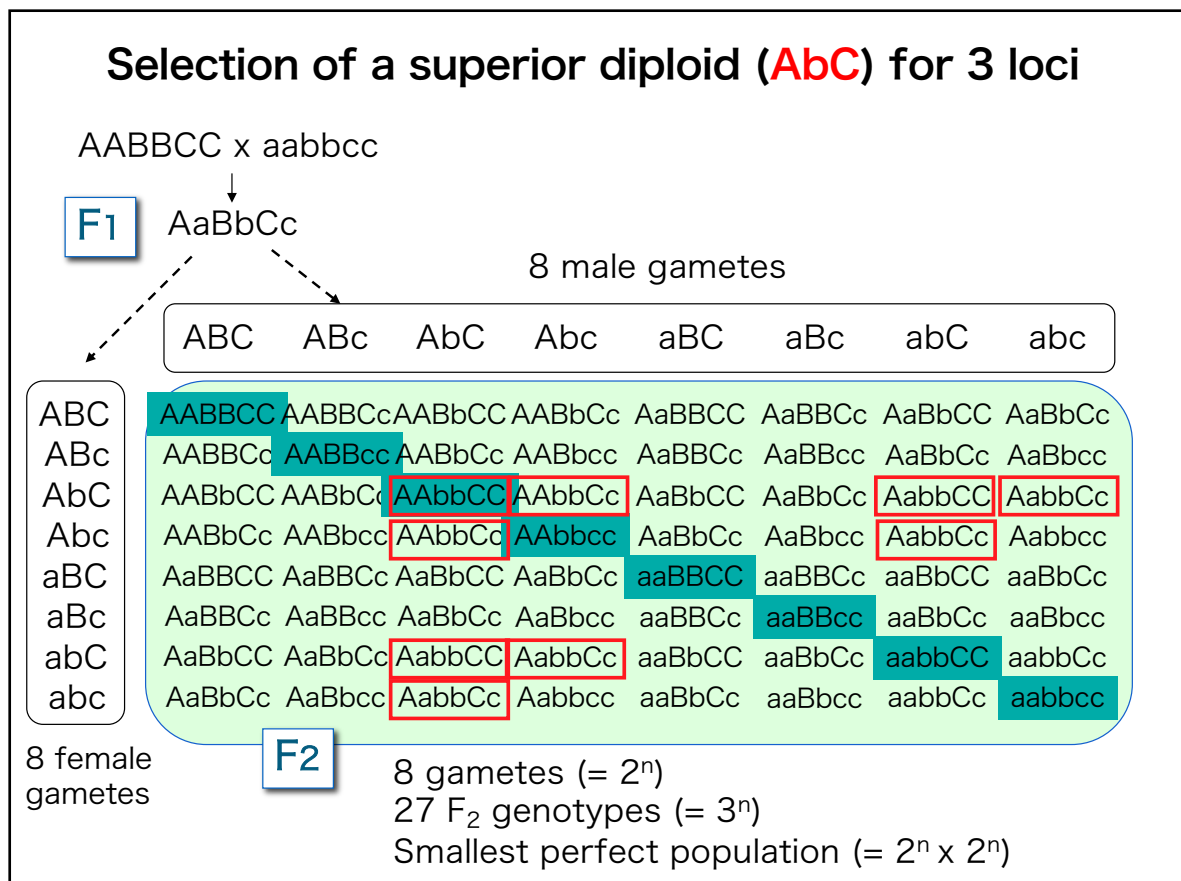
1



2



3



4

Selection against different numbers of loci

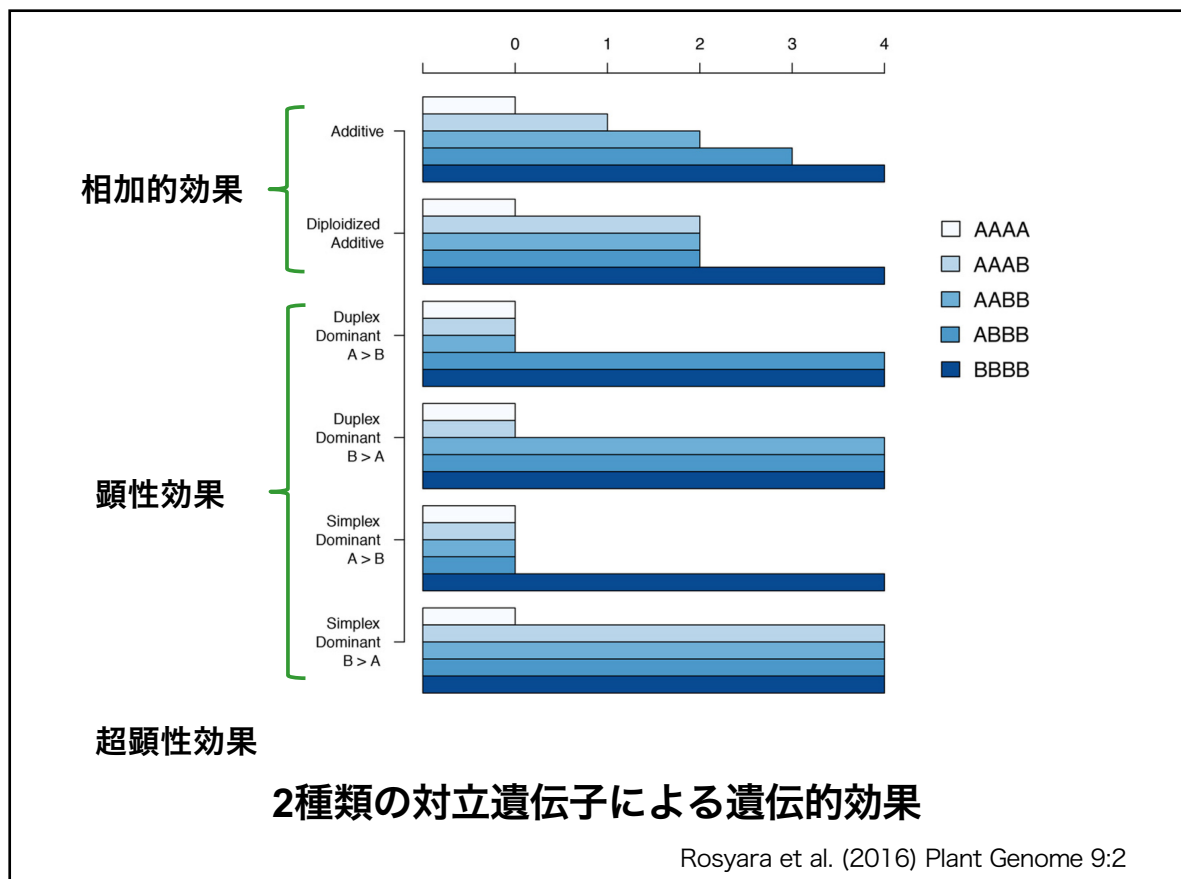
Diploid F₂ genotypes (AA, Aa, aa)

Item	General formula	No. of loci (n)					
		1	2	3	5	10	20
Gametes	2^n	2	4	8	32	1024	1,048,576
F ₂ genotypes	3^n	3	9	27	243	59,049	3.49E+9
Population size	$2^n \times 2^n$	4	16	64	1024	1,048,576	1.10E+12

Tetraploid F₂ genotypes (AAAA, AAAa, AAaa, Aaaa, aaaa)

Gametes	3^n	3	9	27	243	59,049	3.49E+9
F ₂ genotypes	5^n	5	25	125	3,125	9,765,625	9.54E+13
Population size	$3^n \times 3^n$	9	81	729	59,049	3.49E+9	1.22E+19

5



6

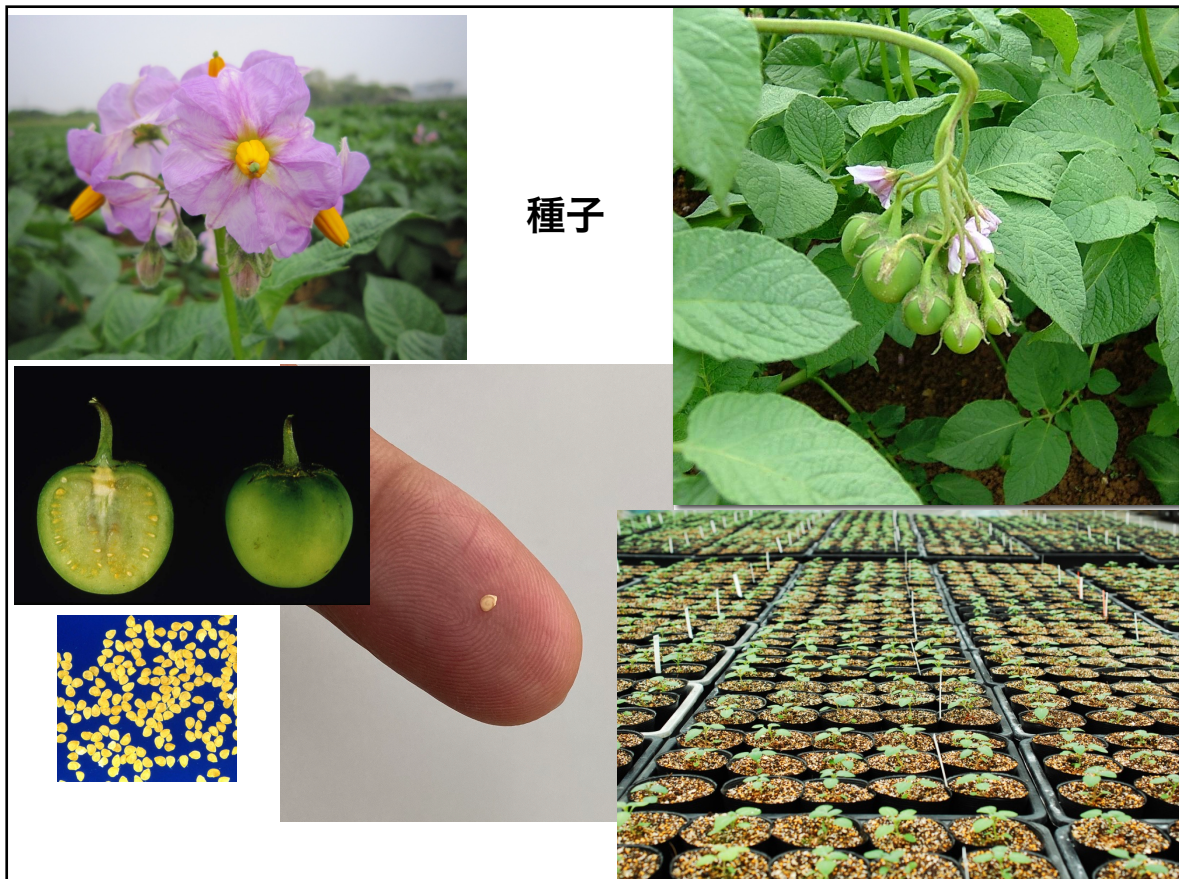
バレイショ育種の流れ

年	供試系統数	株数	選抜段階
1	-	-	交配
2	50,000	1	実生個体選抜
3	12,000	1	第二次個体選抜
4	800	8	系統選抜
5	60	32	生産力検定予備
6	20	32 x 3	生産力検定
7	5	-	生産力検定および特性検定
8~11	1	-	同上および地域適応性試験
12	1	-	品種登録

圃場

点線面
多面

7



8

Innovation in potato breeding



同じ10株分

種芋からF₁種子へ (バレイシヨ2倍体F₁育種)

Seed potatoes

Vegetatively
propagated highly
heterozygous
autotetraploid

Clonally uniform

2x inbred-based
F₁ hybrid seeds

Genetically uniform

9

	種芋	vs	種子
ウイルスの伝達	あり		なし
土壌病害の伝達	あり		なし
増殖率	10倍		>2000倍
1個重	50 g		0.7 mg
10aあたり必要量	225 kg		3.15 g
保存性	0.5~1年		>30年
貯蔵性	専用冷蔵倉庫		家庭用冷蔵庫
輸送	トラック、船、貨車		郵便
生産計画	長期的計画生産		常時、品種をストック
需給バランス	天候に左右される		状況に応じて調整
品種選択の自由度	長期計画に依存		自由
育苗期間	なし		1ヶ月
初期生育	旺盛		弱い
育種素材	4倍体		2倍体
育種操作	交配と選抜		純系を作り交配と選抜
目的遺伝子の集積	遅い		早い
収量性	ほぼ頭打ち		不明

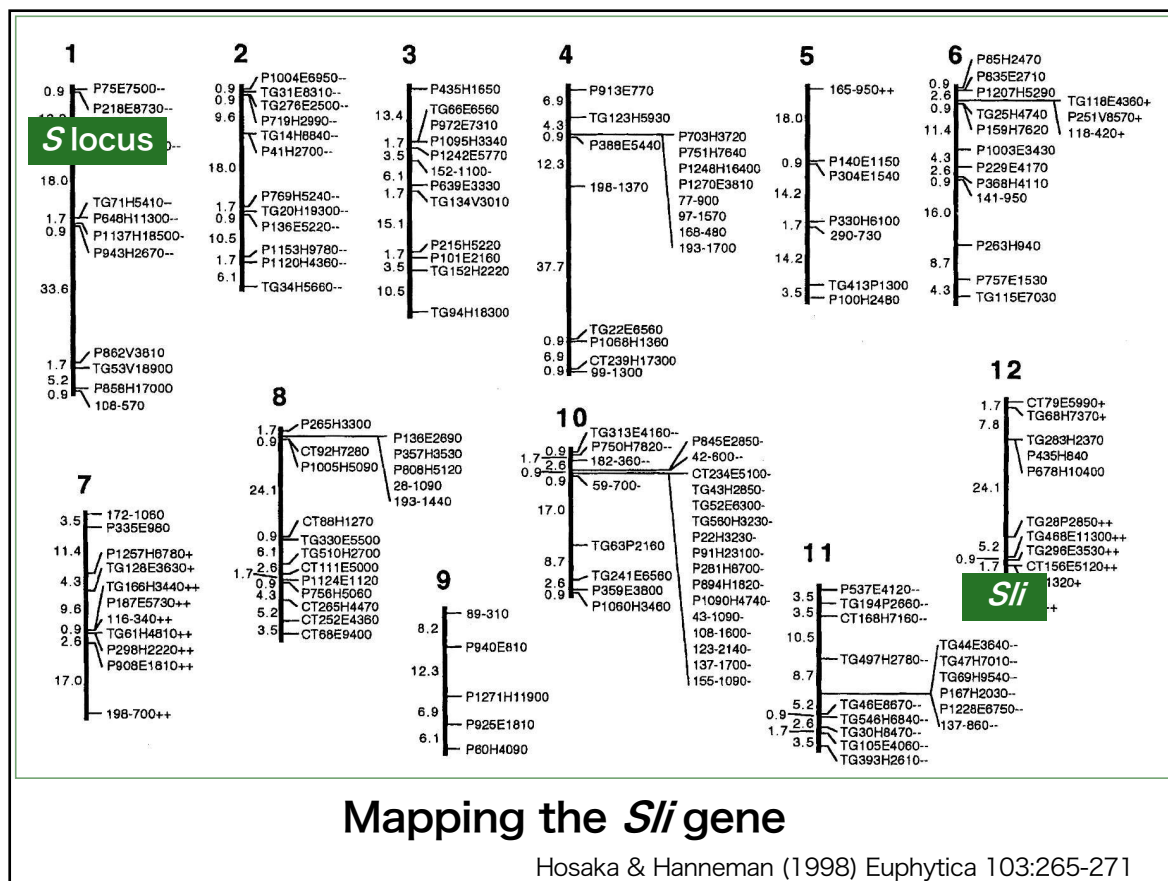
自家和合性 *Solanum chacoense* の発見

Self Fertility in Solanum chacoense. Hanneman, Jr., R.E., USDA, ARS, NCR, University of Wisconsin-Madison, Madison, Wisconsin.

Several lines of *S. chacoense* have been inbred to the S4 to S6 generation. Inbreeding was begun in an attempt to associate the S-locus with a specific chromosome using the trisomic series. This effort was given up when it was determined that self-compatibility may have been introduced into some of the trisomic lines. In this study, nearly half of the progeny of several families set over 100 seeds per fruit. The range in seeds per fruit across all families was 0-590 with family averages ranging from 3-108. While rigorous genetic analysis has not been done, and may be confounded by pseudo-compatibility, selfing rates among the selected families can be explained with as few as two genes being involved. *Paper not read.*

Hanneman (1985) Am Potato J 62:428-429

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Neofunctionalisation of the *Sli* gene leads to self-compatibility and facilitates precision breeding in potato

Ernst-Jan Eggers^{1,2}, Ate van der Burgt¹, Sjaak A. W. van Heusden², Michiel E. de Vries¹, Richard G. F. Visser², Christian W. B. Bachem² & Pim Lindhout¹

Genetic gain in potato is hampered by the heterozygous tetraploid genome of cultivated potato. Converting potato into a diploid inbred-line based F1-hybrid crop provides a promising route towards increased genetic gain. The introduction of a dominant S-locus inhibitor (*Sli*)

Eggers et al. (2021) Nature Communications 12:4141

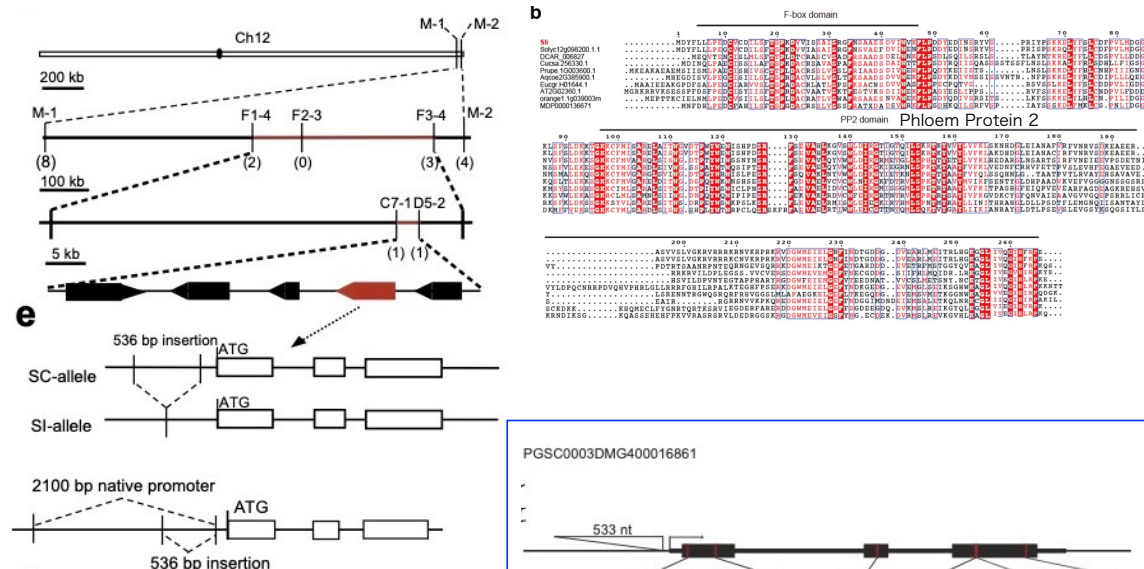
A nonS-locus F-box gene breaks self-incompatibility in diploid potatoes

Ling Ma^{1,7}, Chunzhi Zhang^{2,7}, Bo Zhang^{1,7}, Fei Tang¹, Futing Li¹, Qinggang Liao², Die Tang², Zhen Peng³, Yuxin Jia², Meng Gao¹, Han Guo⁴, Jinzhe Zhang⁵, Xuming Luo², Huiqin Yang¹, Dongli Gao¹, William J. Lucas^{2,6}, Canhui Li¹, Sanwen Huang² & Yi Shang¹

Potato is the third most important staple food crop. To address challenges associated with global food security, a hybrid potato breeding system, aimed at converting potato from a tuber-propagated tetraploid crop into a seed-propagated diploid crop through crossing inbred

Ma et al. (2021) Nature Communications 12:4142

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Sli gene functions like a general S-RNase inhibitor.

Ma et al. (2021) Nature Communications 12:4142

The 533 bp insertion in the promoter of *Sli* originated from a transposable element.

Eggers et al. (2021) Nature Communications 12:4141

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2倍体F₁育種の課題

- 自殖弱勢 (inbreeding depression) が激しい
  自殖世代を進めると稔性が著しく低下する
- バレイショ品種の2ゲノム性単数体の多くは雌雄不稔
  多くの単数体を作る必要がある
- バレイショ品種の2ゲノム性単数体 (T型細胞質) にP型細胞質の花粉を交配するとさまざまな雄性不稔を生ずる
  交配組み合わせを考慮する必要がある
- 自殖世代を進めると遺伝子は絞られてくる
  自殖を始める最初の個体に必要な形質 (*Sli* 遺伝子、早生、高収量、高品質、病虫害抵抗性) を持たせる必要がある