**Purpose:**

* To reinforce the understanding of visualization and application of markers in plant breeding
* To reinforce the application of linkage
* To emphasize the difference between functional and linked markers

**Keywords**: inbred line, hybrid, backcross, DNA, nucleotide, PCR, agarose gel, SSR marker, SNP marker

**References:** CG Linkage Module 5

**CG ALA-5\_Linkage Module 5**

1. PRR78 is a desirable inbred line that is used in hybrid rice production. It is susceptible to the bacterial blast disease. An inbred line C101A51 has the *piz 5* allele that confers resistance to the disease. An SSR marker AP5930, which is closely linked to the *piz 5* allele, has a DNA fragment 160bp long for PRR78 and 180bp long for C101A51. You cross PRR78 to C101A51 and backcross the F1 to PRR78 to obtain BC1F1 plants (Gouda et al., 2013. Marker-assisted breeding of *Pi-1* and *Piz-5* genes imparting resistance to rice blast in PRR78, restorer line of Pusa RH-10 Basmati rice hybrid. Plant Breeding 61:61-69)

Draw a picture of an agarose gel showing the PCR products from amplification of the AP5930 marker that includes lanes for the DNA of PRR78, C101A51, the F1 hybrid and the BC1F1 genotypes. Clearly label the gel wells at the starting point with the name of the samples. Indicate on the side of the gel, the size of each of the bands in your picture.

2. Two homozygous rice plants differ by a single nucleotide (G/A) in the starch synthase IIa gene that affects cooking quality in rice.

(a) What type of molecular marker is it? Explain your answer.

(b) Is this a functional marker or linked marker? Explain your answer.

(c) You crossed these two plants and obtained F1 plants. Illustrate the DNA sequences for the marker in the F1 plants. Be sure to show the double-stranded DNA, and clearly indicate the base difference between the two alleles.

(d) Describe and illustrate the differences between a SSR marker and a SNP marker.