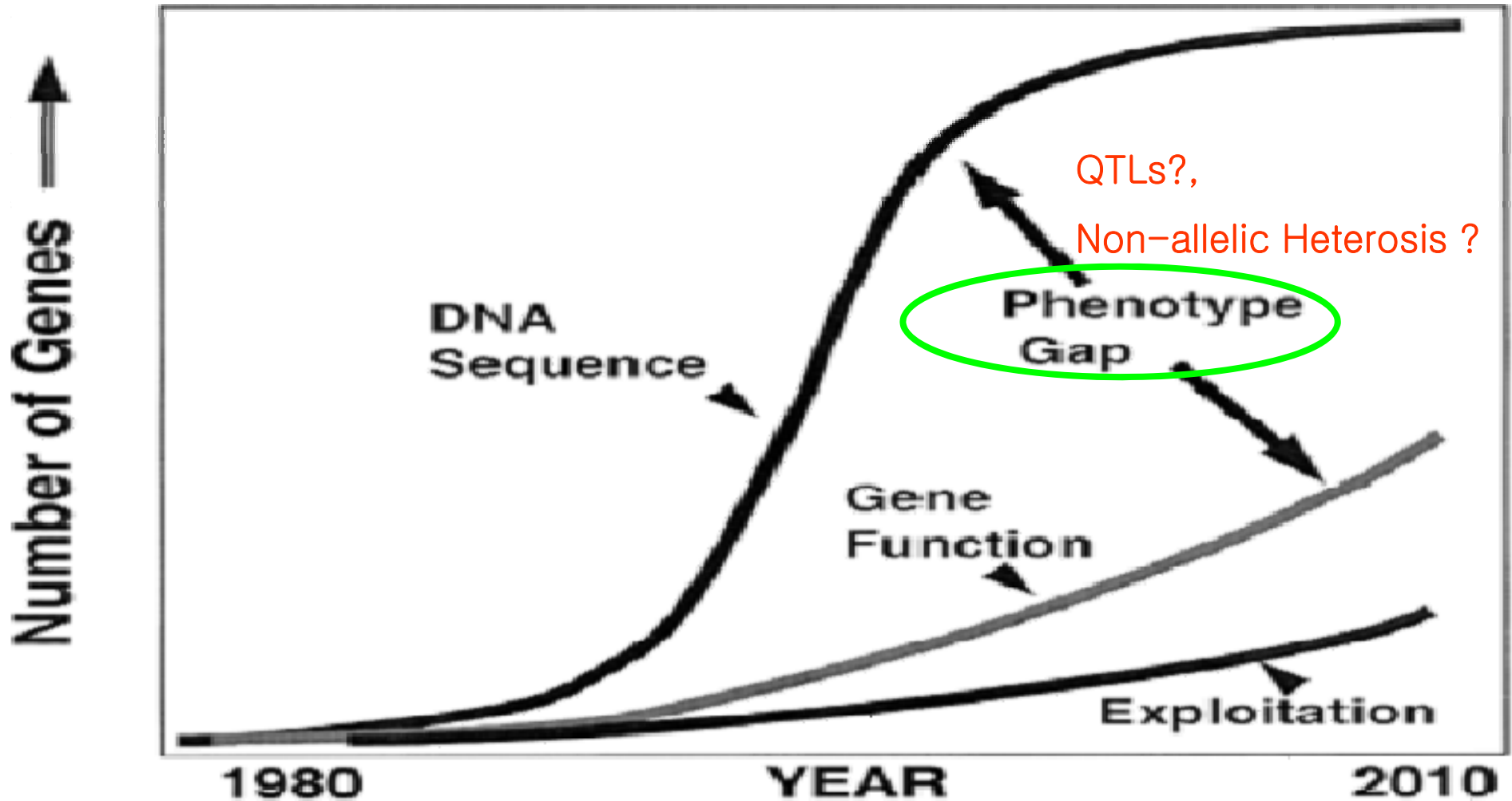


What is the QTLs and NON- Allelic Heterosis ?





Wide Hybridization



- To transfer resistance to diseases and insects into japonica rice : **BI, BB, BPH, RBSDV, ShB, Stemborer**
- Transfer of genes for **weed competitive ability** from African rice (*O. glaberrima*) into japonica rice
- Molecular characterization of alien introgression
 - **Tagging of alien genes/QTLs and molecular cytogenetics**
- Development of **near-isogenic alien introgression** lines for use in functional genomics





Production of F1 hybrids between japonica cultivars and wild species of *Oryza* ('03 – '06)



| | F1 hybrids | Method | Remarks |
|------------------|--------------------------------|---------------|--|
| <i>O. sativa</i> | Wild species | | |
| Jinmibyeo | x <i>O. rufipogon</i> (AA) | Direct cross | Intermediate in morphology, partially sterile, normal chromosome pairing |
| Ilpumbyeo | x <i>O. rufipogon</i> (AA) | Direct cross | Partially sterile |
| Ilpumbyeo | x <i>O. longistaminata</i> AA) | Direct cross | Highly sterile |
| Hwacheongbyeo | x <i>O. glaberrima</i> (AA) | Direct cross | Highly sterile |
| Ilpumbyeo | x <i>O. punctata</i> (BB) | Direct cross | Completely sterile |
| Jinmibyeo | x <i>O. officinalis</i> (CC) | Embryo rescue | Completely sterile |
| Ilpumbyeo | x <i>O. minuta</i> (BBCC) | Embryo rescue | Completely sterile |
| Junambyeo | x <i>O. minuta</i> (BBCC) | Embryo rescue | Completely sterile, limited pairing, irregular meiosis |
| Junambyeo | x <i>O. alta</i> (CCDD) | Embryo rescue | Completely sterile |
| Ilpumbyeo | x <i>O. ridleyi</i> (HHJJ) | Embryo rescue | Seedlings in test tubes |



Breeding of elite lines from a cross of
 Hwaseonbyeo x *O. minuta* (2n=48, BBCC) 

| Variety | Year | Heading (mon.day) | Culm length (cm) | Disease resistance | | | Yield (t/ha) |
|-------------------|------|----------------------|------------------------|--------------------|-------------|-------------|-----------------|
| | | | | BI (1-9) | BB (1-9) | BSDV (%) | |
| Suweon 487 | '02 | 8.14 | 78 | 7 | 7 | 0 | 5.46 |
| Suweon 497 | '03 | 8.21 | 72 | 7 | 1 | ND | 4.94 |
| Suweon 506 | '04 | 8.13 | 109 | 1 | 1 | ND | 6.14 |
| Hwaseongbyeo | - | 8.12 | 85 | 7 | 8 | 56.3 | 5.22 |

* BI, Blast; BB, Bacterial blight; BSDV, Black streak dwarf virus





Evaluation of Wide Cross Progenies





**Introgression Lines from Crosses
of Japonica x Wild Rices**



Breeding Program
In KOREA





Targets of Rice Breeding



For Farmers

**Higher income (yield/quality)
Easier cultivation
Resistance to biotic and abiotic stress
Less materials**

For Consumers

**Good taste to be safe
Nutrient to be cheap
Easy to process
Rich in functional ingredients**

For Environment

**Less chemicals
Enrich biodiversity
Beautiful landscape**

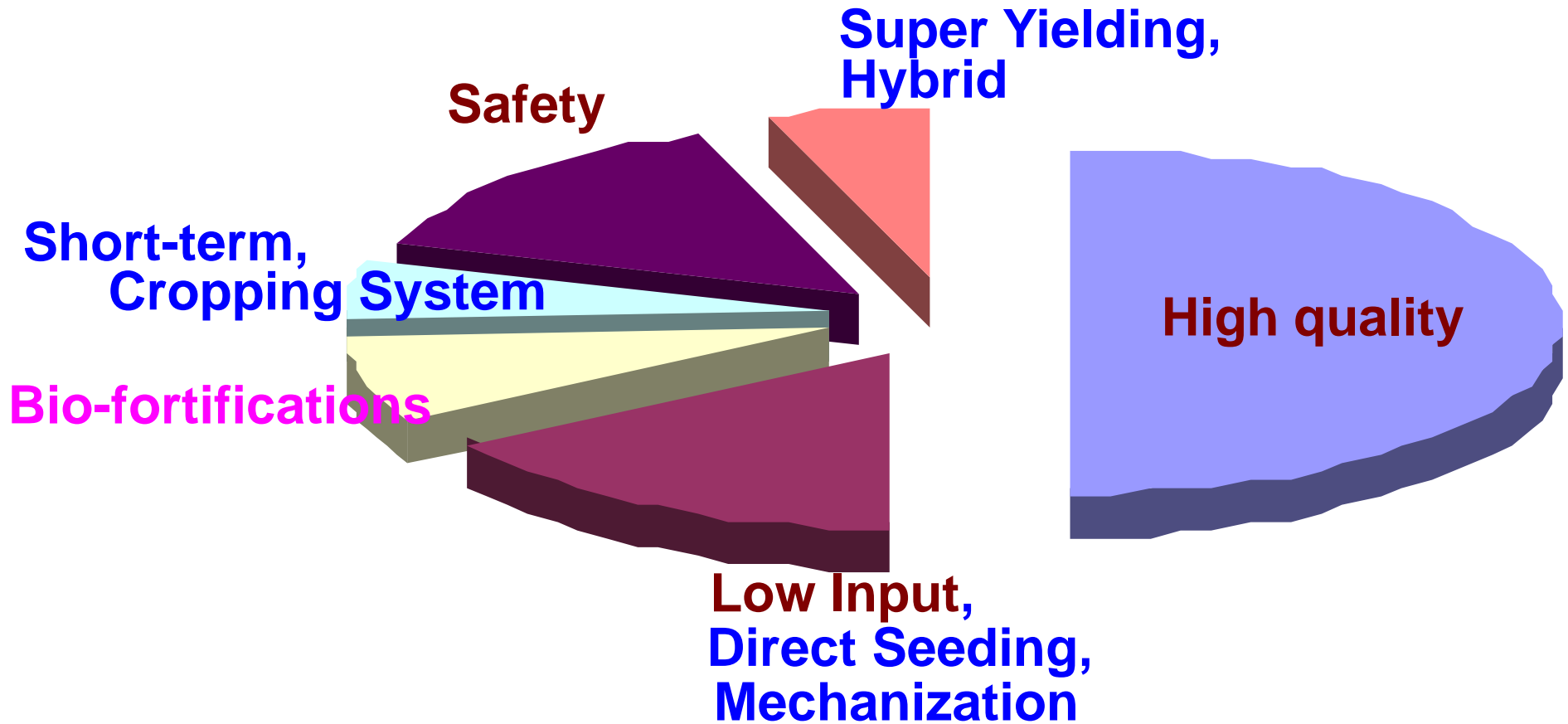
For Future

**Super high yielding
Sustain high yielding system
Enhance protein and oil yield**





Rice Breeding Program in KOREA





The Goal of Rice Breeding Program in KOREA (I)



- ❖ **Development of high-palatable rice cultivars each institute**
 - **Central zone adaptation with blast, brown planthopper resistance and with cold tolerance**
 - **West-southern region adaptation with bacterial blight resistance and with salinity tolerance**
 - **East-southern region adaptation with virus resistance and with cold salty wind tolerance**





The Goal of

Rice Breeding Program in KOREA (II)



- ❖ **Development of high-quality rice cultivars adaptable to direct seeding**
 - **Lodging resistance**
 - **Better germination & emergence at low temperature**
 - **High-adaptability in dense planting**

- ❖ **Development of short-term rice cultivars adaptable to late transplanting after cash crops**
 - **Growth duration : shorter than 95days**
 - **Grain productivity per day : above 60 kg/ha**





The Goal of Rice Breeding Program in KOREA (III)



- ❖ **Development of value added Functional rice cultivar**
 - **Low-albumen rice (low-Glutelin rice)** for treatment and prevention of diabetes, kidney disease, chronic renal failure, etc.
 - **Developing rice varieties that have 16kDa globulin removed and have anti-allergy property (decreases atopy, etc.)**
 - **Developing iron-fortified rice varieties** for pregnant women to prevent efficiency of red blood cells or anemia
 - **Developing varieties with antioxidant function, such as high Anthocyan content in black brown rice.**
 - **Developing gamma aminohutyric acid in rice** for blood pressure letdown
 - **Developing Pro-vitamin A in rice** for night blindness prevention
 - **Developing Isoflavone in rice varieties** for the control of female hormone
 - **Developing low-content protein in rice** for wine





The Goal of Rice Breeding Program in KOREA (IV)



- ❖ **Development of new rice materials using biotechnology**
 - **Enhancement of transgenic or regeneration efficiency**
 - **Identification & isolation of useful gene sources**
- ❖ **Development of super-yielding rice cultivars**
 - **Target (2010) : 10 t/ha in milled rice**
 - ✓ **Multi-resistance to major diseases and insect pests**
 - ✓ **Whole crop silage 20 t/ha in korea**
 - **New rice materials for super-yielding hybrid rice**
 - ✓ **Utilization of wide-cross compatibility genes**
 - ✓ **Enhancement of hybrid-seed productivity**





The Vision of Rice Breeding in KOREA



2015

Milled rice yield(t/ha)

- High-quality rice : 6.5
- High-yielding rice : 10.0

Double cropping & Reduction cost

- Short-growth duration
 - Less than 100 days.
 - Grain yield : > 6.0kg/day/10a
- Adaptability to direct seeding
 - Lwo-temp germinability
 - Lodging tolerance,
 - Low tillering : < 10 tillers



Grain quality

- High quality rice
 - Marketing & milling quality
 - Eating quality
- High-yielding rice
 - Diversified grain size, shape
 - Physicochemical properties
- Value added functional .

Safety in cultivation

- Stability of resistance to disease & insect pests
- Tolerance/Resistance to environmental stresses
- suitable for regional specificity



Rice Breeding Practices

