

Global Solutions for Late Blight Management: Evaluating the Success of 3 R-Gene Potatoes in the Diverse Agricultural Landscapes of Asia and Africa.



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The Feed the Future Global Biotech Potato Partnership (GBPP)

- **Partnership:** A five-year multi-institution cooperative agreement between USAID, MSU, the International Potato Center (CIP) and the University of Idaho in partnership with leading international research institutions.
- **Target countries:** Bangladesh, Indonesia, Kenya and Nigeria
- **Product:** Late Blight Resistant Potato



Global Biotech Potato Partnership Objectives

1. Demonstrate commercial potential of 3 R-gene LBR potato technology with field trials in target countries.
2. Regulatory submission for general release of the 3 R-gene LBR potato.
3. Product deployment through biotech seed system and stewardship.
4. Second-generation disease resistant (DR) potato.
5. Communication and Advocacy.

GBPP 3R-Gene Late Blight Resistance Technology

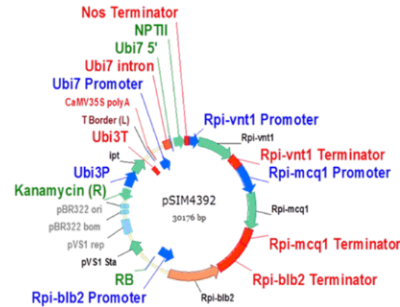
Simplot Plant Sciences 3R-gene T-DNA (Diamant and Granola)

3 Rpi-genes with highest resistance levels

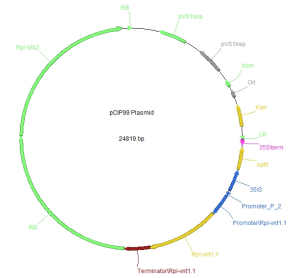
Rpi-vnt1.1 from *Solanum venturii*

Rpi-mcq1 from *Solanum mochiquense*

Rpi-blb2 from *Solanum bulbocastanum*



MSU: pSIM4392



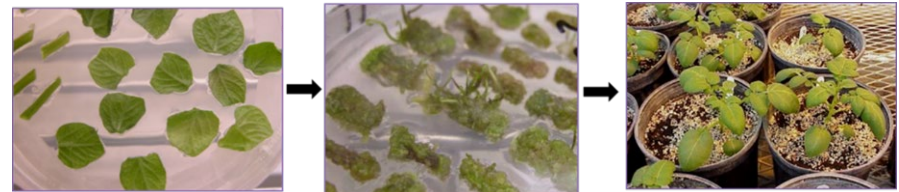
CIP: pCIP99

CIP-KENYA 3R-gene T-DNA (Shangi, Tigoni, Victoria)

Rpi-vnt1.1 from *Solanum venturii*

Rpi-RB from *Solanum bulbocastanum*

Rpi-blb2 from *Solanum bulbocastanum*



Agrobacterium Potato Transformation

Southeast Asia Target Countries: Bangladesh and Indonesia

Bangladesh

- small holder farmers
- high cost of inputs
- scarcity of cold storage facilities
- crop damage by insect pests and disease (particularly late blight)
- Reduction of yield in field and damage in storage



Indonesia

- small holder farmers
- high cost of inputs
- terraced (all land is utilized)
- extremely high late blight disease (infection starts at emergence)



Southeast Asia GBPP LBR Potato Products:

Bangladesh

- Diamant farmer preferred variety
- Diamant 3R-gene LBR events UB015, UB255



Indonesia

- Granola farmer preferred variety
- Granola 3R-gene LBR events UG234, UG265



Sub-Saharan African Target Countries: Nigeria and Kenya

Nigeria

- small holder farmers
- high cost of inputs
- build on the current efforts from CIP to improve the local supply of clean potato seed
- approved for research and release of biotech Bt-cowpea



Kenya

- 800,000 small holder potato farmers
- high cost of inputs
- Pests and diseases contribute to an estimated 80% reduction in production
- Key crop in Kenya's economy
- Build on CIP-Kenya's current value chain efforts



Sub-Saharan Africa GBPP LBR Potato Products:

Nigeria

- Diamant farmer preferred variety
- Diamant 3 R-gene LBR events and CIP 3 R-gene LBR



Kenya

- Victoria, Tigoni and Shangi farmer preferred varieties
- Victoria, Tigoni and Shangi 3R-gene LBR lines



Confined field trial setup

- To test the efficacy of the 3-R-gene construct in the potato varieties for Asia and sub-Saharan Africa field trials have been carried out in Bangladesh, Indonesia and Kenya.
- Test lines and non-gm cultivars were tested in a factorial randomized complete block design fungicide x cultivar trial.
- In Bangladesh trials were carried out in Gazipur, Rangpur, Chittagong and Munshiganj from November 2023 - March 2024.
- In Indonesia trials are being carried out in Pangalengan and Lembang, West Java and Kledung, Central Java.
- In Kenya, trials were carried out in Muguga, Njabini and Molo from October 2023 – March 2024.
- Agronomy data, (emergence, plant height and width, stem number) and late blight incidence and severity, were rated during the season and tuber weight and number were assessed at harvest.

Bangladesh Confined Field trials

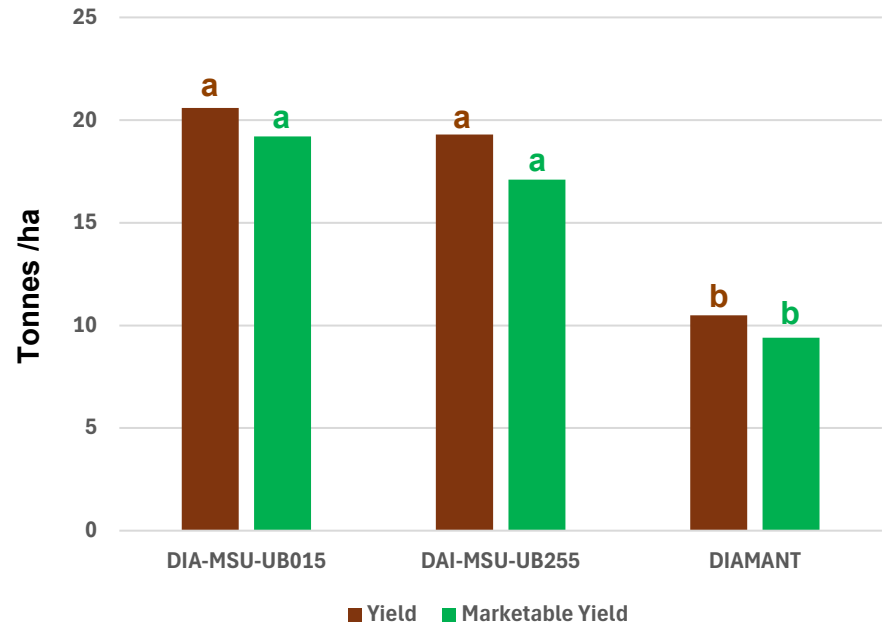
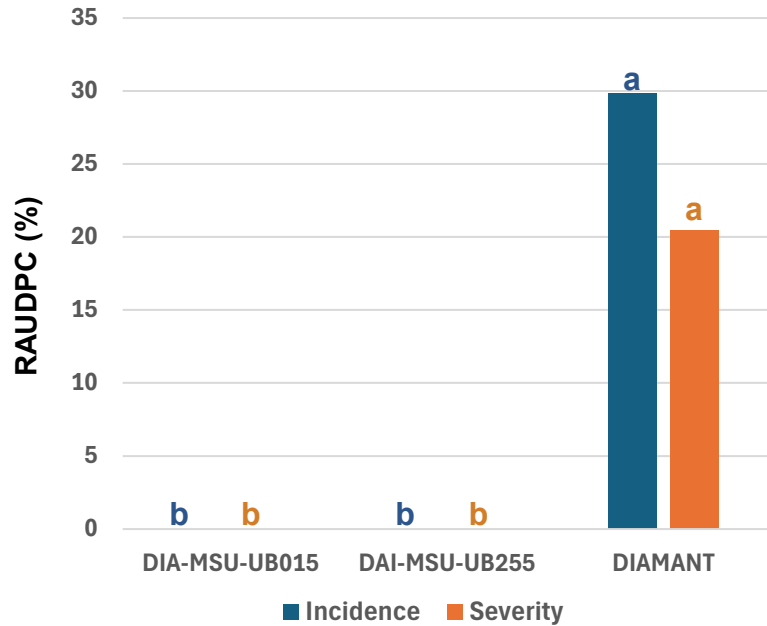


Gazipur, Dhaka

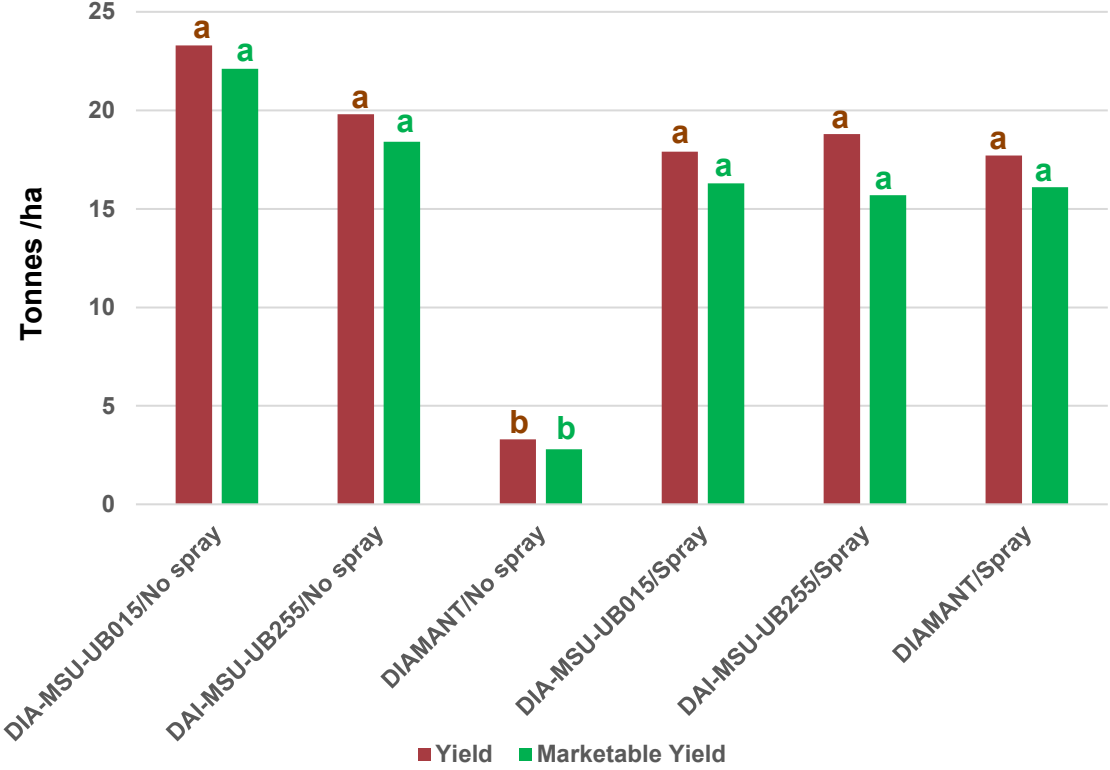


Rangpur, Rangpur

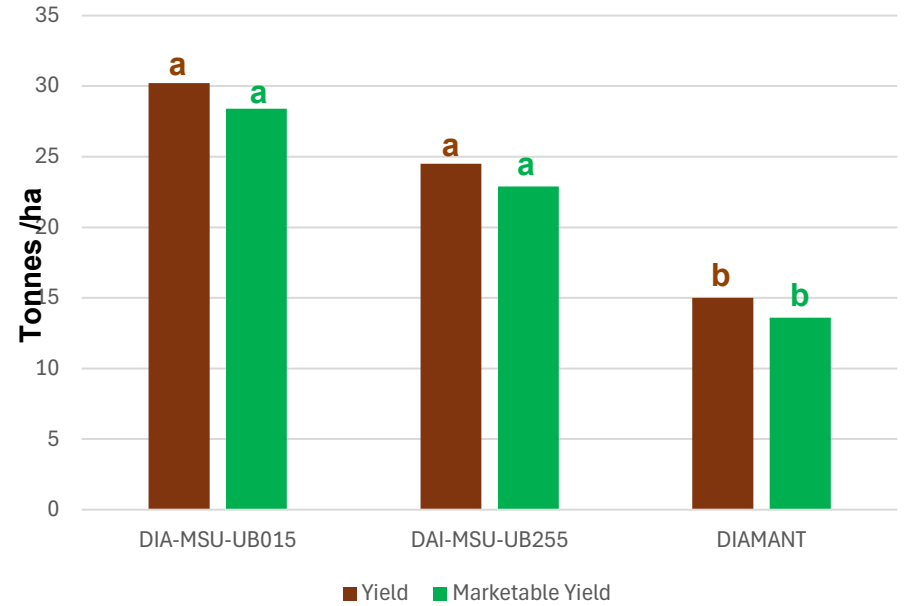
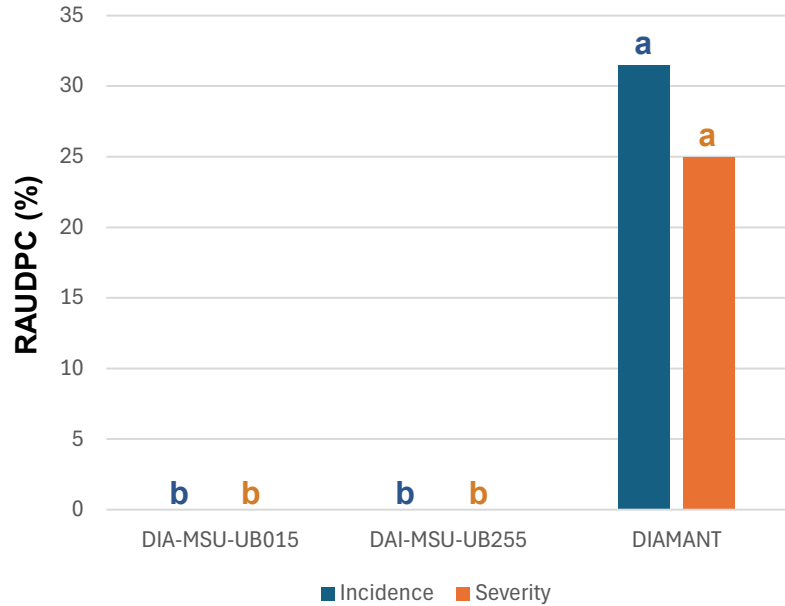
Gazipur Results



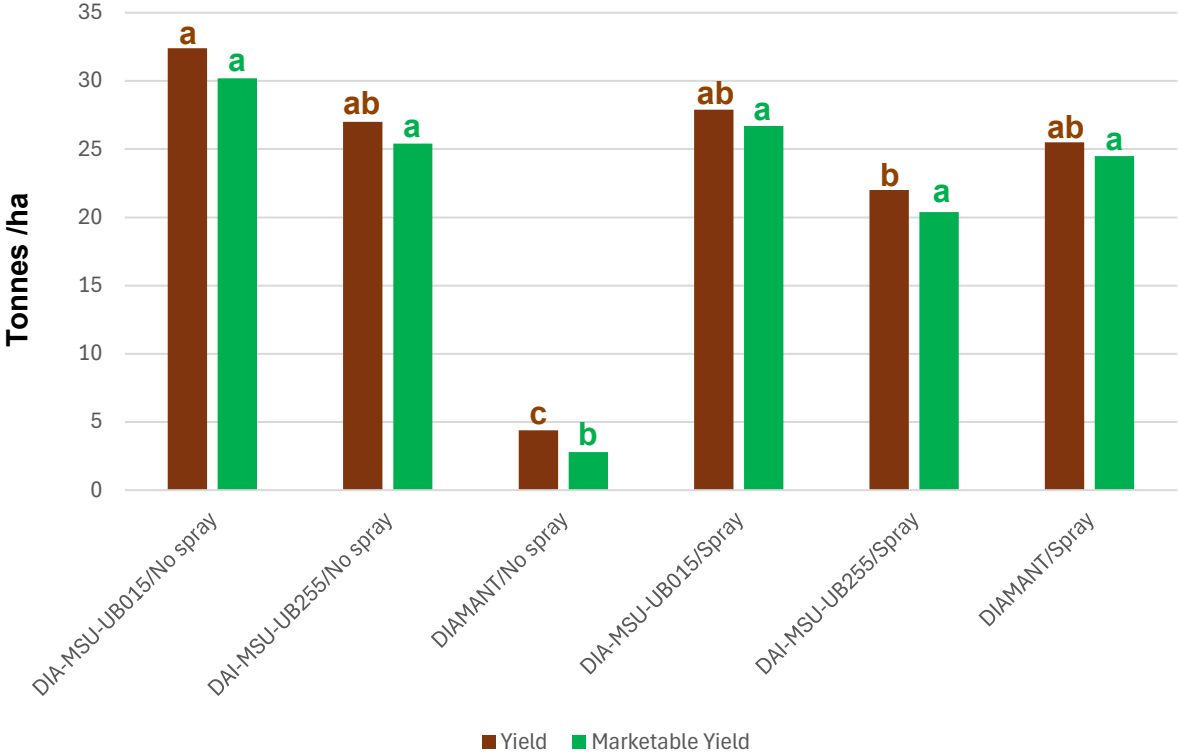
Gazipur Results



Rangpur Results



Rangpur Results



Bangladesh Summary

- Late blight did not occur in the trials at Chittagong and Munshiganj.
- No late blight was found in any of the 3 R-gene plots at Gazipur or Rangpur.
- Yields were similar at Gazipur and Rangpur with the yields of 3 R-gene lines being not significantly different in sprayed vs non-sprayed plots. While in non-GM Diamant yields were significantly lower in non-sprayed plots.

Indonesia Confined Field trials (in progress 60 dap)



Sprayed Plots



Non-GM Granola (sprayed)

Pangalengan, W. Java

Indonesia Confined Field trials (in progress 60 dap)



Non-Sprayed Plots



Non-Sprayed Granola

Non-Sprayed UG234

Pangalengan, W. Java

Indonesia Confined Field trials (in progress 60 dap)



UG234 (sprayed)



Non-GM Granola (sprayed)

Lembang, W. Java

Indonesia Confined Field trials (in progress 60 dap)



Non-Sprayed
Granola

Non-Sprayed UG234



Non-Sprayed
Granola

Non-Sprayed UG234

Lembang, W. Java

Indonesia Summary

- No late blight was found in any of the 3 R-gene plots at Pangalengan or Lembang.
- 1 R-gene variety BioGranola develops late blight about 60 days after planting.

Kenyan Confined Field trials



Muguga

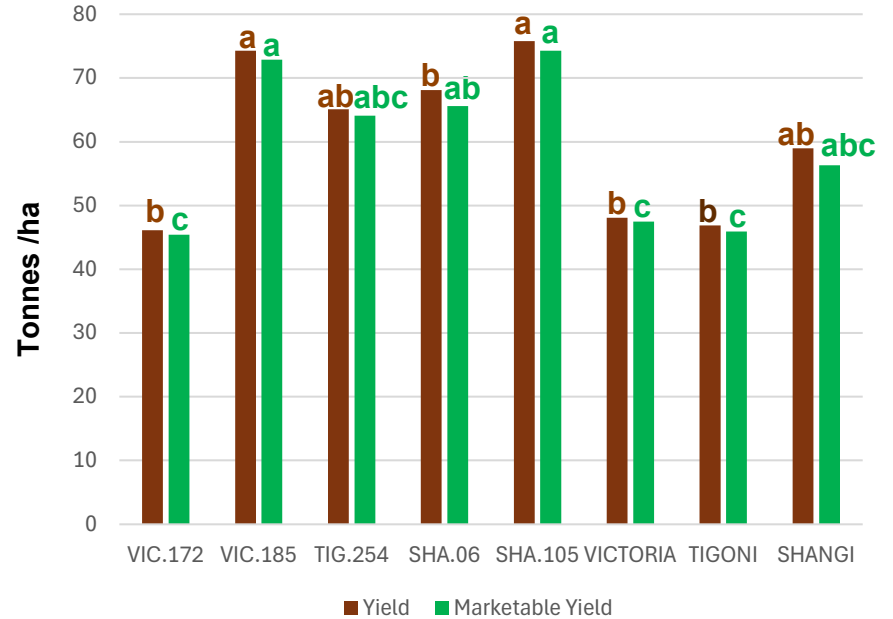
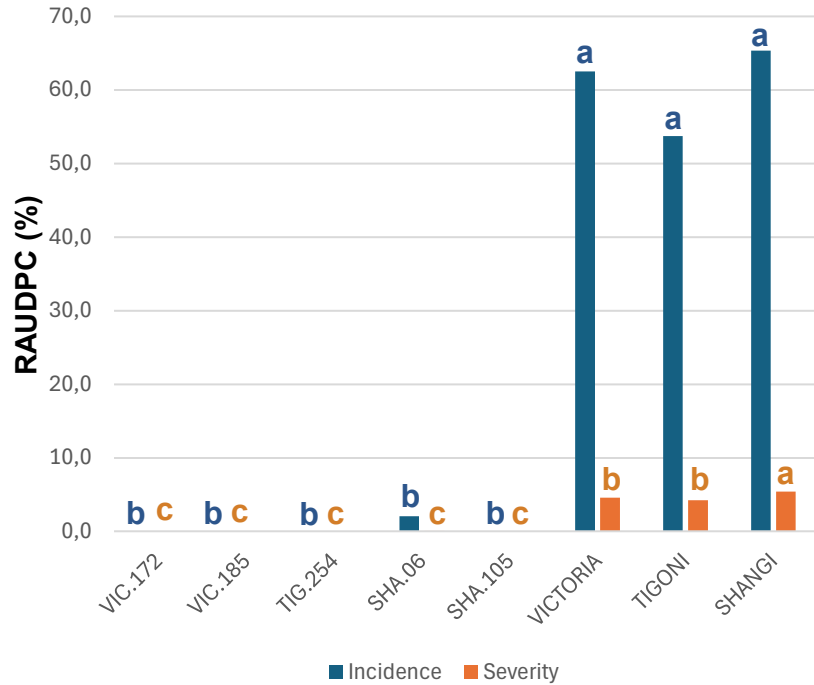


Njabini



Molo

Muguga Results



Indonesia Summary

- Late blight was patchy at Njabini and Molo.
- Occasional lesions were found in 3 R-gene plots in Muguga and Njabini on Tigoni.254 and Shangi.06.
- Yields were significantly higher in Vic.185 and Sha.105 than the other lines.
- Sha.105 has been selected for commercialization.

Global Biotech Potato Partnership

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