# Findings on the Testing of a New Rice Genotype (Candidate Variety) for Commercial Cultivation in Guyana

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**Rice Research Station, Burma, Guyana.**

# Features

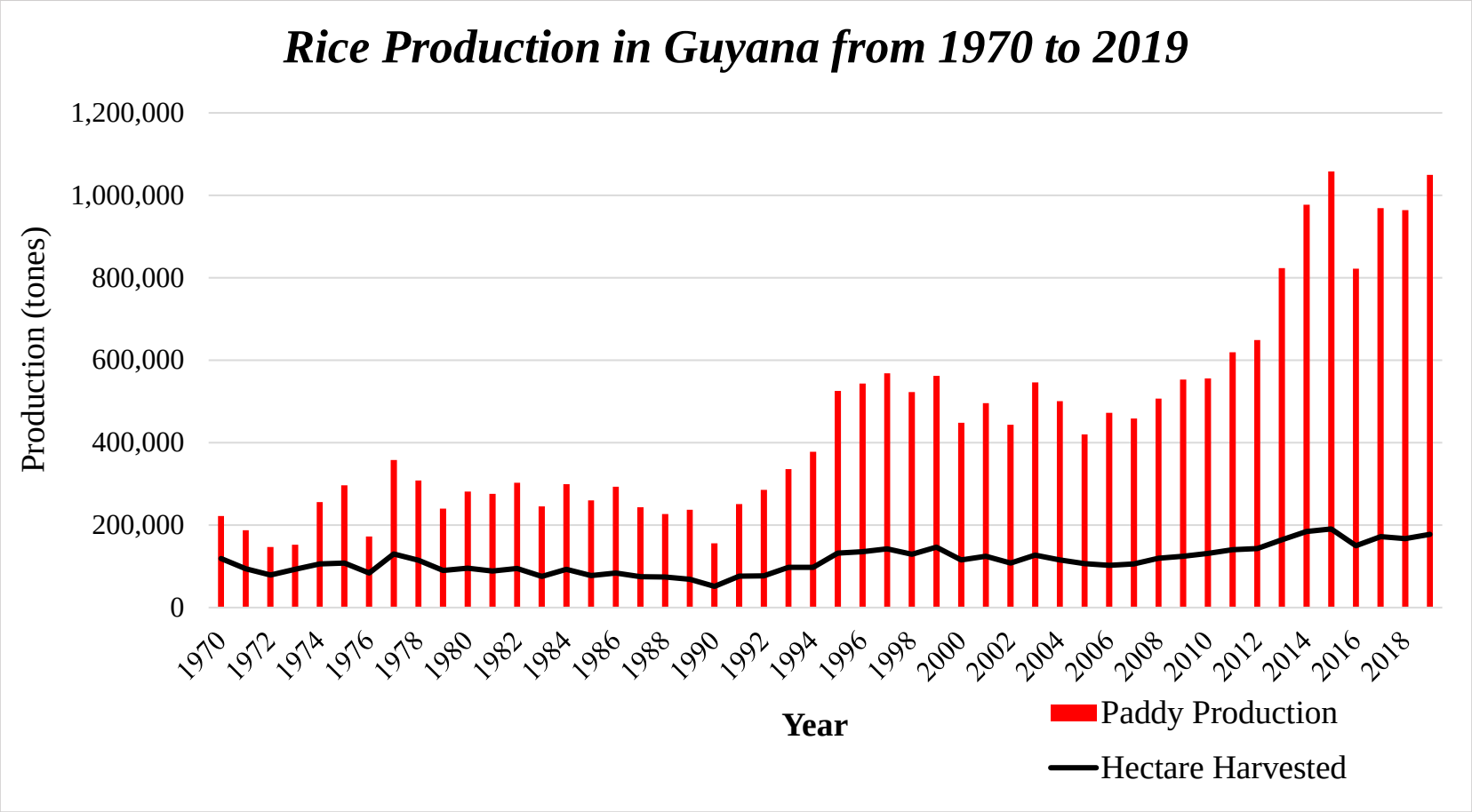
- Introduction
- Breeding Objectives and Procedure
- Results
- Farmer Response
- Seed Stock
- Conclusions
- Recommendations

# Introduction

- Rice is crucial for global food security.
- Locally, Rice makes us food secure.
- Per Capita, consumption of milled rice in Guyana is about 80 kg.
- We export more than 80% of our produce.
- Approx 6,500 farmers cultivate rice
- Rice accounts for 3.3% of Guyana's total Gross Domestic Product (GDP) and 20.5% agriculture GDP (2018).

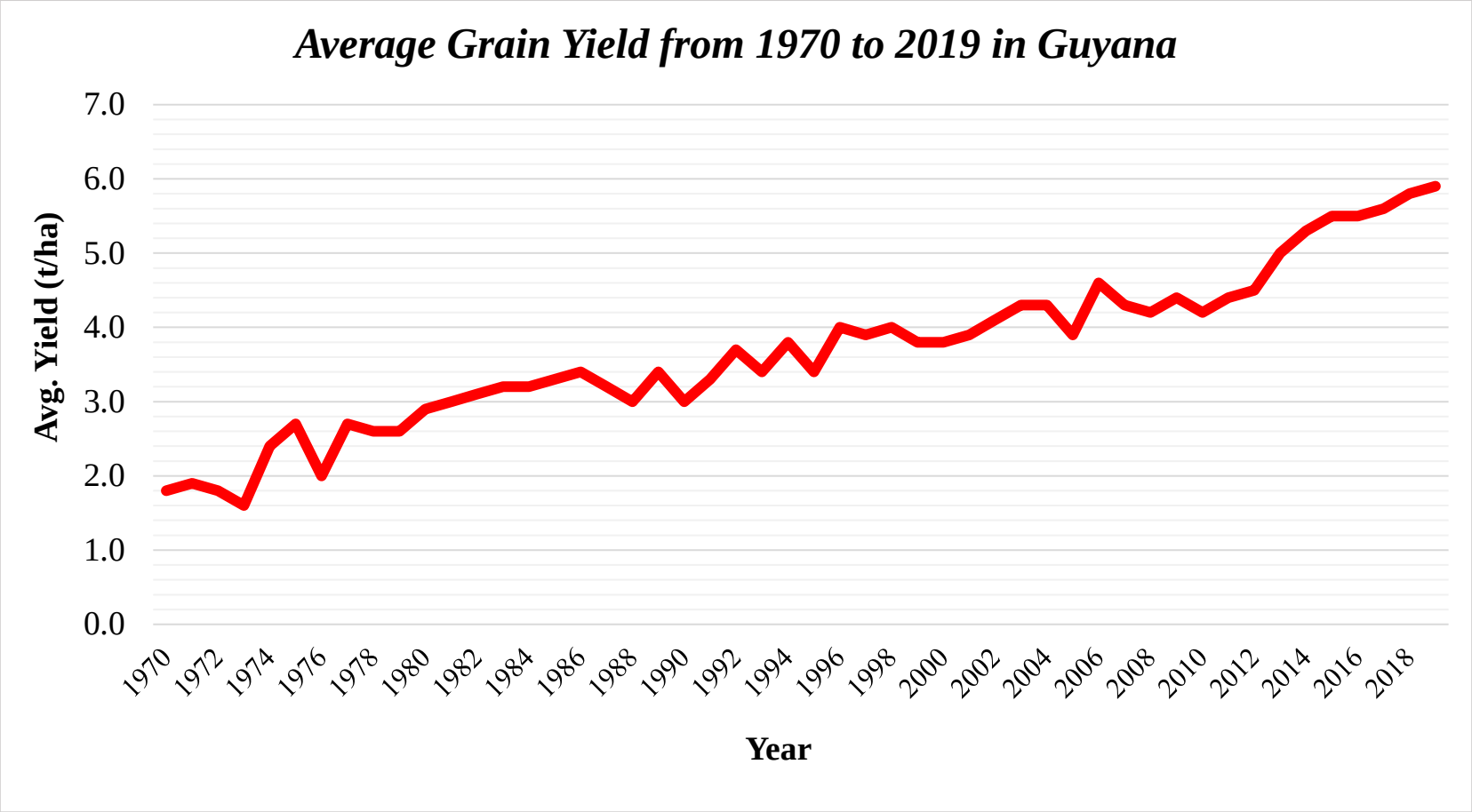
# Introduction

Rice Production in 2019: 1, 049874 M/T



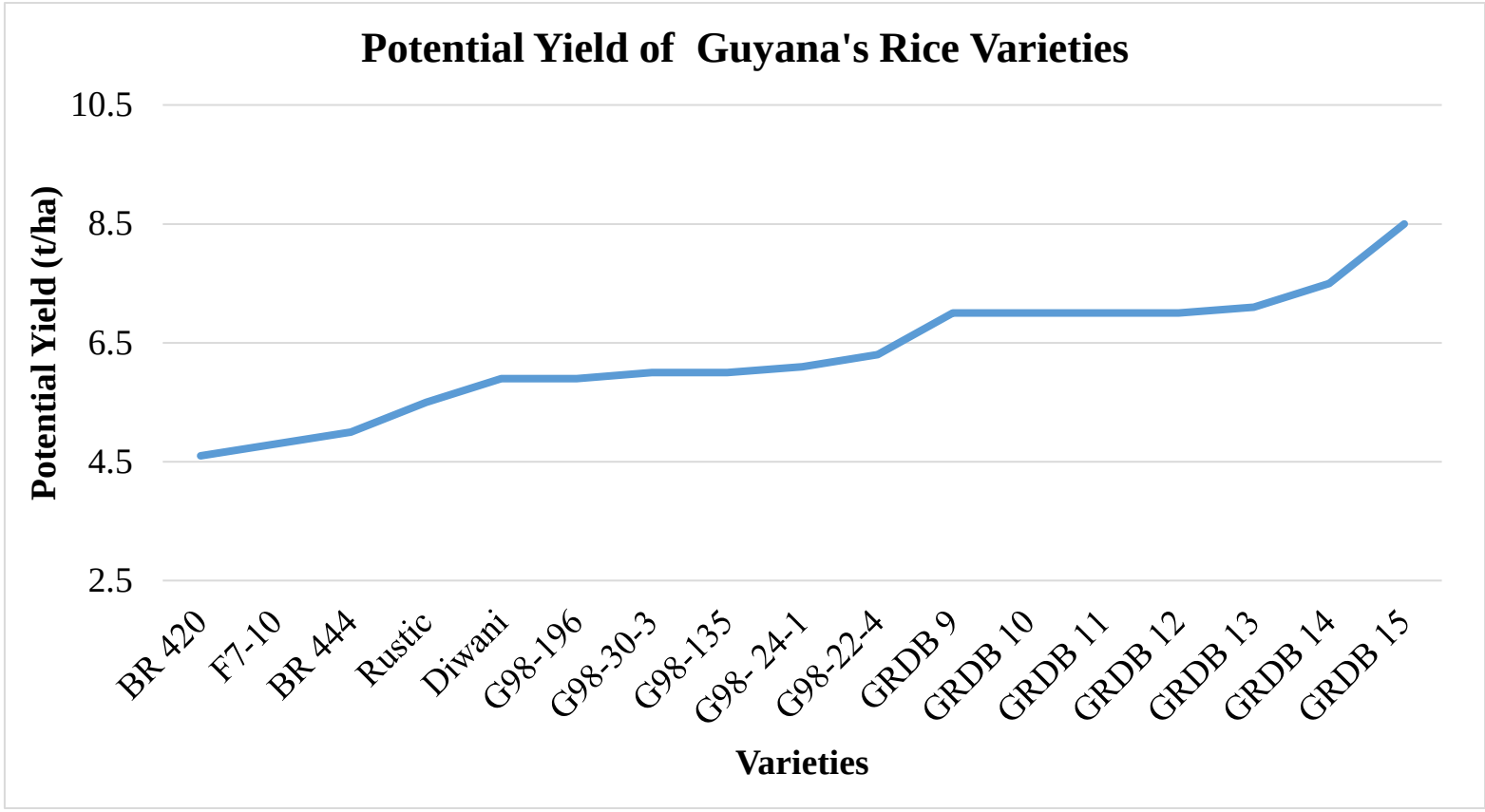
# Introduction

Rice Productivity in 2019: 5.91 t/ha



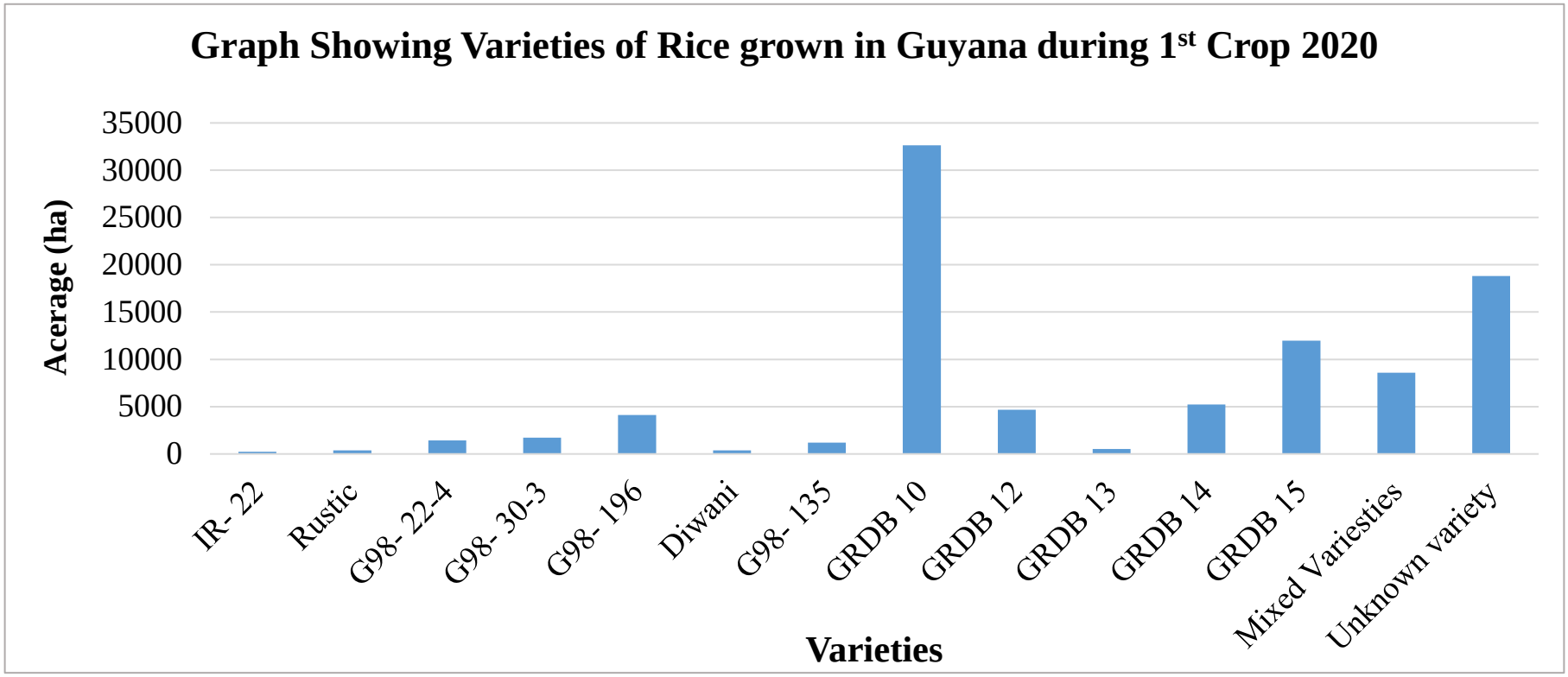
# Introduction

## Yield Potential of Varieties



# Introduction

Area of GRDB 10: 35.5%; GRDB 15: 13% (1st crop 2020)



# Breeding Objectives

The major objective of the rice breeding program is to develop rice varieties with:

- high yield potential (>7 t/ha);
- tolerance to lodging;
- stable resistance to blast;
- high milling (HRR 55/TRR 70);
- excellent cooking qualities.

Other Objectives: Specialty Rice (Aroma), Salt Tolerance, Diverse Grain Types

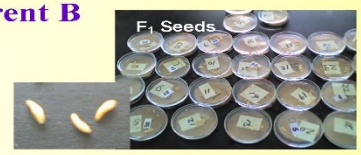
# SCHEMATICS OF RICE BREEDING


## ACCESSING GERMPLASM / IDENTIFYING PARENTS


## Hybridization

**Parent A X Parent B**

*1st Season*




## $F_1$ SEEDS


## $F_1$ GENERATION

*2nd Season*


## Breeding Nurseries

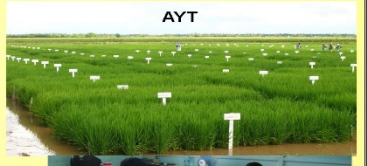
## $F_2$-$F_5$ GENERATION

*3rd - 6th Season*




## $F_6$-$F_7$ GENERATION

*7th-8th Season*




Introductions From Other Institutes

Observational Nursery

Preliminary Yield Testing

## OBSERVATIONAL YIELD TRIAL (OYT)

*9th Season*

STRAIN PURIFICATION


Multi-location Yield Testing

## ADVANCED YIELD TRIAL (AYT)

*10th-12th Season*

Nucleus/ Pre Basic Seed Production

Seed Production

Large Scale Testing of Promising Strains on Farmers' Fields

Large Scale Testing

## ON FARM TRIAL (OFT)

*13th-14th Season*

## VARIETAL RELEASE & DISTRUBUTION

*15th Season*

# Breeding Details

- **Testing Designation:** FG12 -259
- **Breeding Designation:** FL10919-10P-5P-3P-1P-M
- **Parentage:** FL07175-1P-1-3P-1P / FL04648-6P-9-3-1P-1P-M//FL07439-9P-1P-3P-M
- **Breeding Method:** Introduction and Selection
- **Plant Breeder:** Mahendra Persaud (GRDB), Edgar Corredor (FLAR), and Eduardo Graterol (FLAR)
- **Proposed Name of Variety:** GRDB FL 16

# Observational Yield Trial

## Autumn 2014

**Strain:** FG 12-259

**Duration:** Early (110 - 112 days)

**Plant type:** Excellent

**Excellent Panicle with very heavy grains**

**Excellent milling and cooking qualities**

**Yield Estimates:** 9285.5 kg/ha (57.8 bags/ac)

# Yield Trial

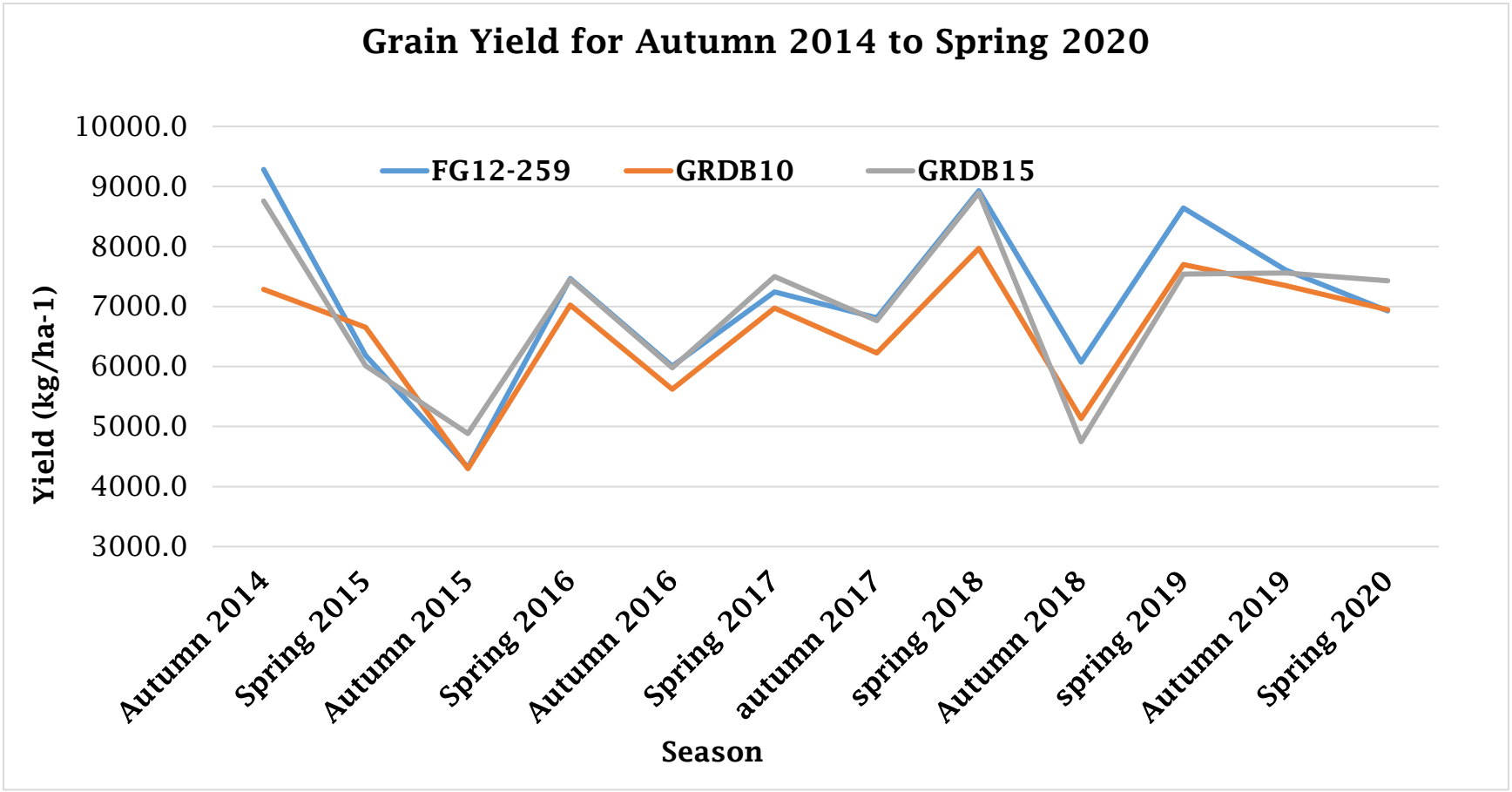
## Grain Yield Over Several Seasons

| Season | Trial | Location | Avg. Yield (Kg/ha-1) | | |
|---|---|---|---|---|---|
| | | | FG12- 259 | GRDB 10 | GRDB 15 |
| Autumn 2014 | OYT | RRS | 9285.5 | 7286.4 | 8760.2 |
| Spring 2015 | AYT | West Dem, RRS & BBP | 6184.3a | 6654.0a | 6013.6a |
| Autumn 2015 | AYT | West Dem, RRS & BBP | 4318.6a | 4300.5a | 4883.0a |
| Spring 2016 | AYT | RRS | 7468.6a | 7025.7a | 7450.a |
| Autumn 2016 | AYT | Reg 2, West Dem, RRS & BBP | 6008.5a | 5623.7a | 5981.9a |
| Spring 2017 | AYT | Reg 2, West Dem, RRS & BBP | 7242.2a | 6974.8a | 7500.5a |
| Autumn 2017 | AYT | Reg 2, West Dem, RRS & BBP | 6813.0a | 6227.8a | 6765.5a |
| Spring 2018 | AYT | Reg 2, West Dem, RRS & BBP | 8932.2a | 7968.0a | 8894.7a |
| Autumn 2018 | AYT | Reg 2, West Dem, RRS & BBP | 6071.1a | 5133.7ab | 4750.5b |
| Spring 2019 | AYT | Reg 2, West Dem, RRS & BBP | 8640.0a | 7699.4b | 7543.1b |
| Autumn 2019 | AYT | Reg 2, West Dem, RRS & BBP | 7609.0a | 7348.4a | 7559.3a |
| Spring 2020 | AYT | Reg 2, West Dem, RRS & BBP | 6945.7a | 6926.7a | 7428.6a |
| | | **AVERAGE** | **7126.6a** | **6597.4a** | **6960.9a** |

**Yield Advantage: 8 % over GRDB 10 and 2.4 % over GRDB 15**

# Yield Trial

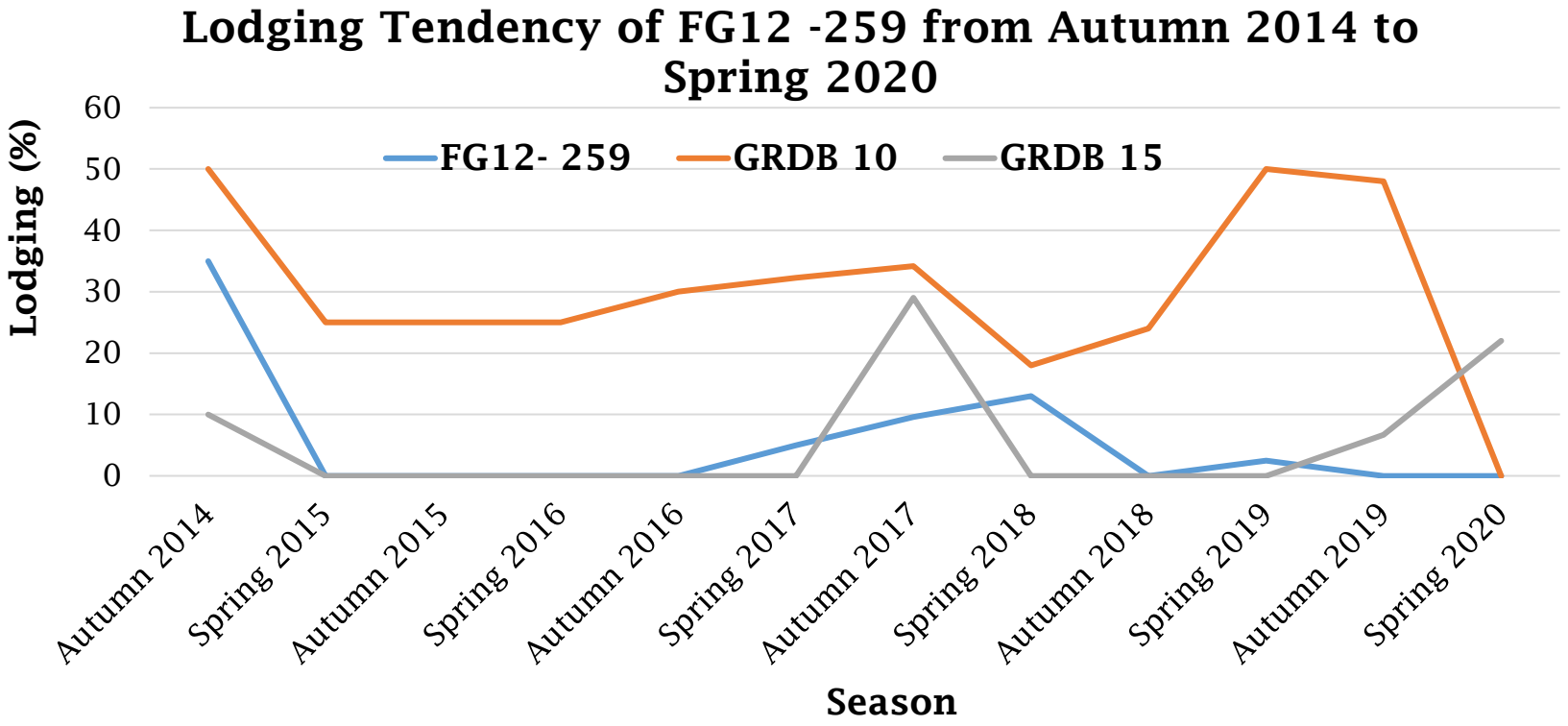
## Grain Yield Over Several Seasons




**Yield Advantage: 8 % over GRDB 10 and 2.4 % over GRDB 15**

# Yield Trial

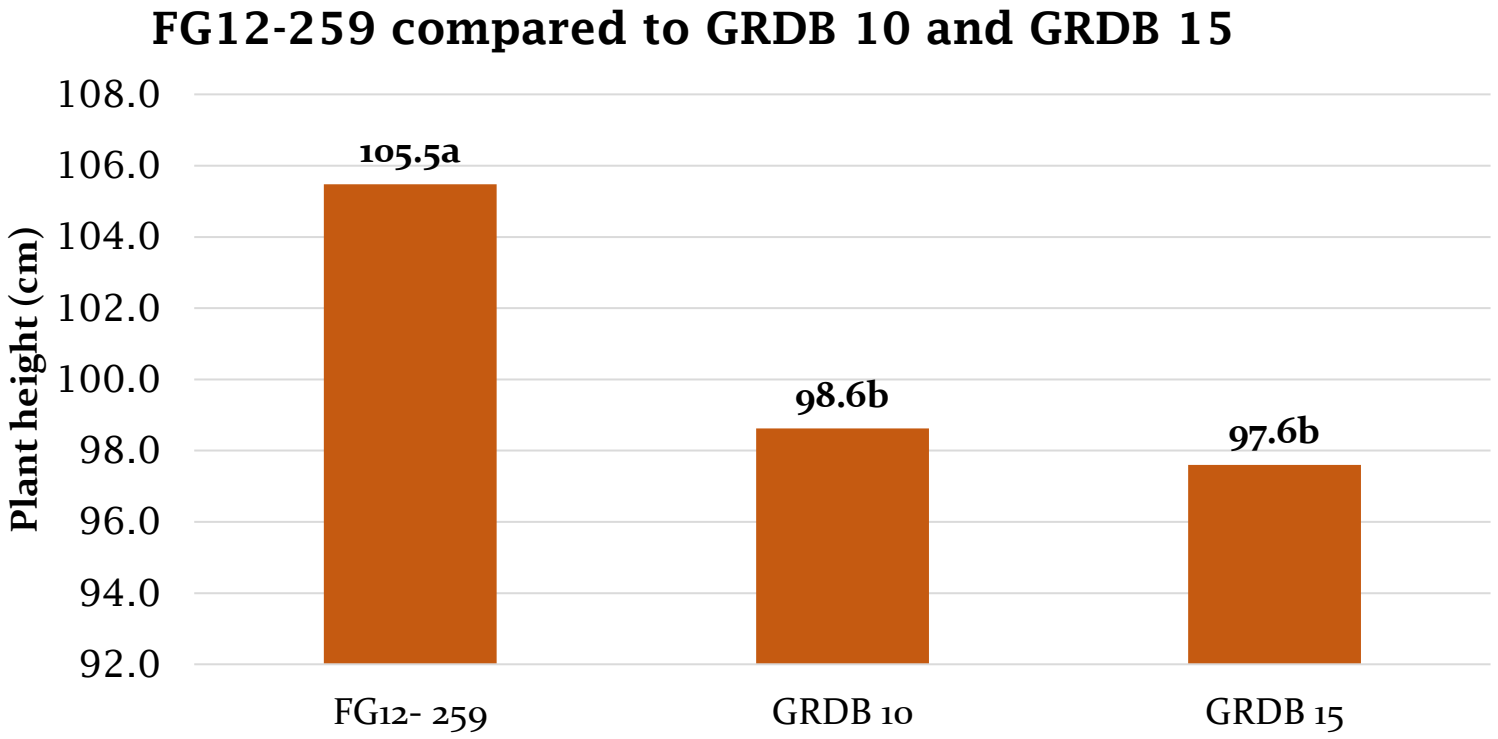
## Lodging Tendency Over Several Seasons




**FG12-259 = 5% lodging compared GRDB 10 = 30%**

# Yield Trial

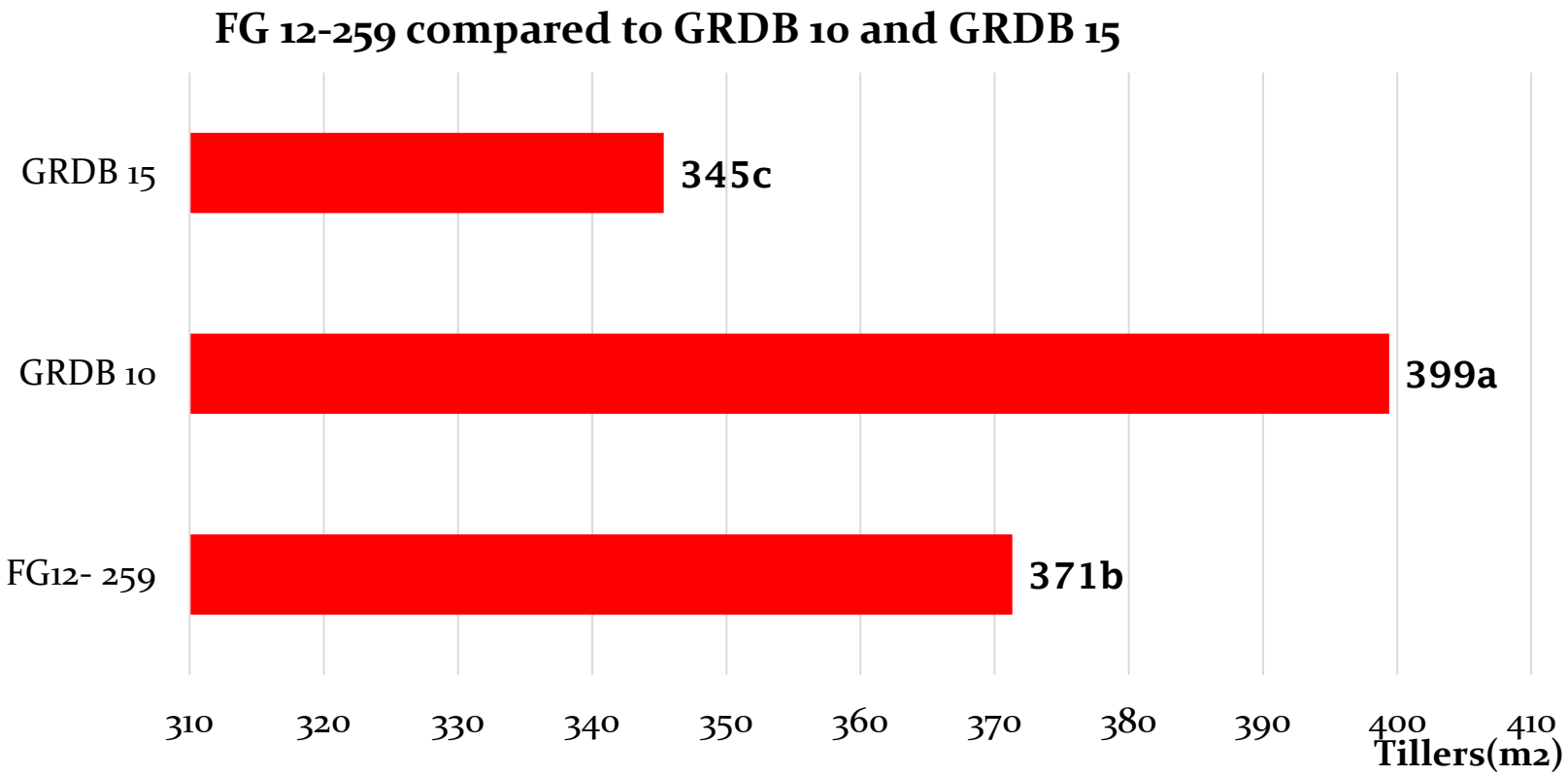
## Plant Height




**FG12-259: 105.5 cm compared to GRDB 10: 98.6cm and GRDB 15: 97.6 cm**

# Yield Trial

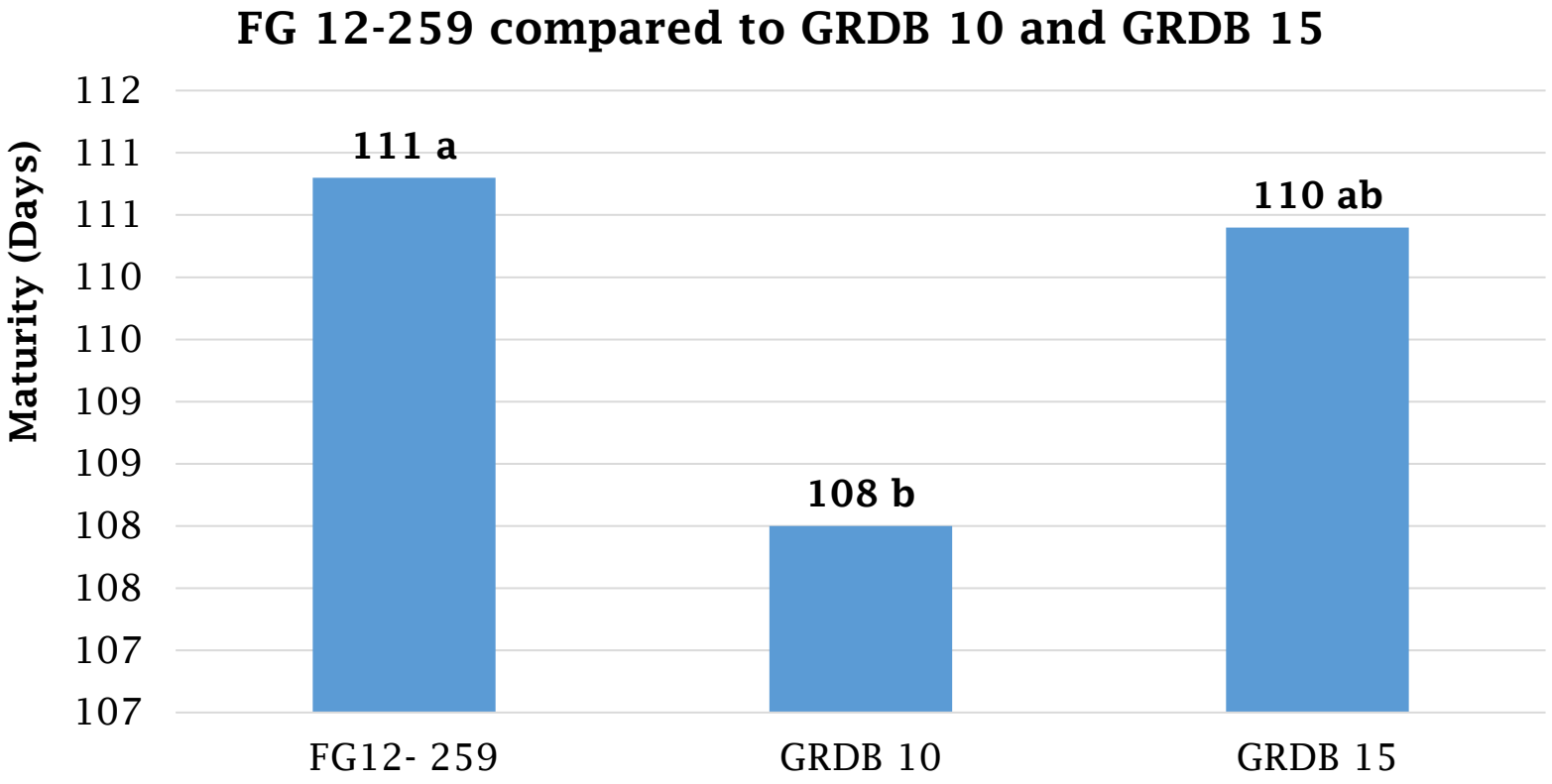
## Tiller Count




**FG12-259: 371 tillers/m² compared to GRDB 10: 399 tillers/m² and GRDB 15: 345 tillers/m²**

# Yield Trial

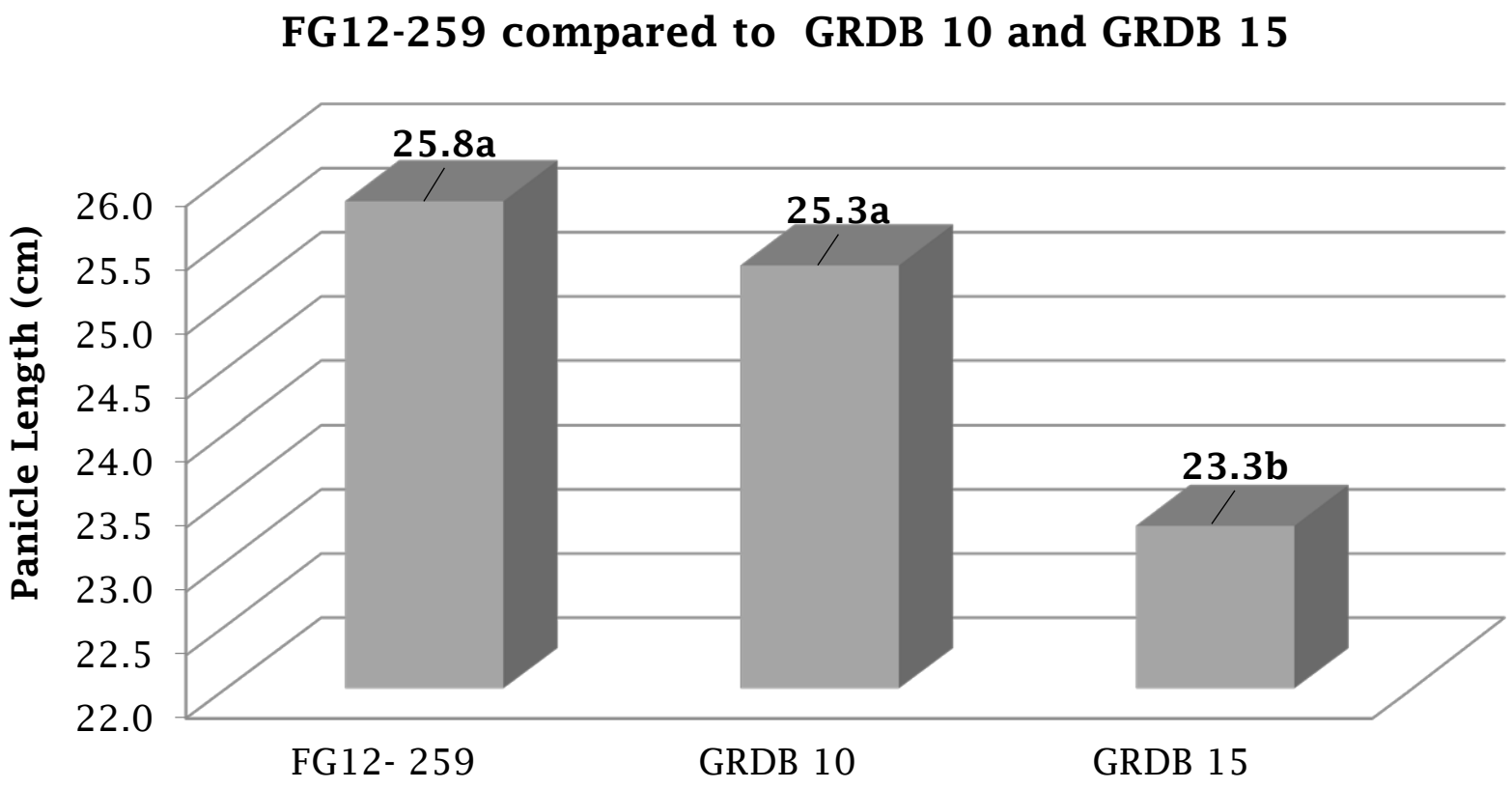
## Maturity




FG12- 259:111 days (short term) similar to the GRDB 10 and GRDB 15

# Yield Trial

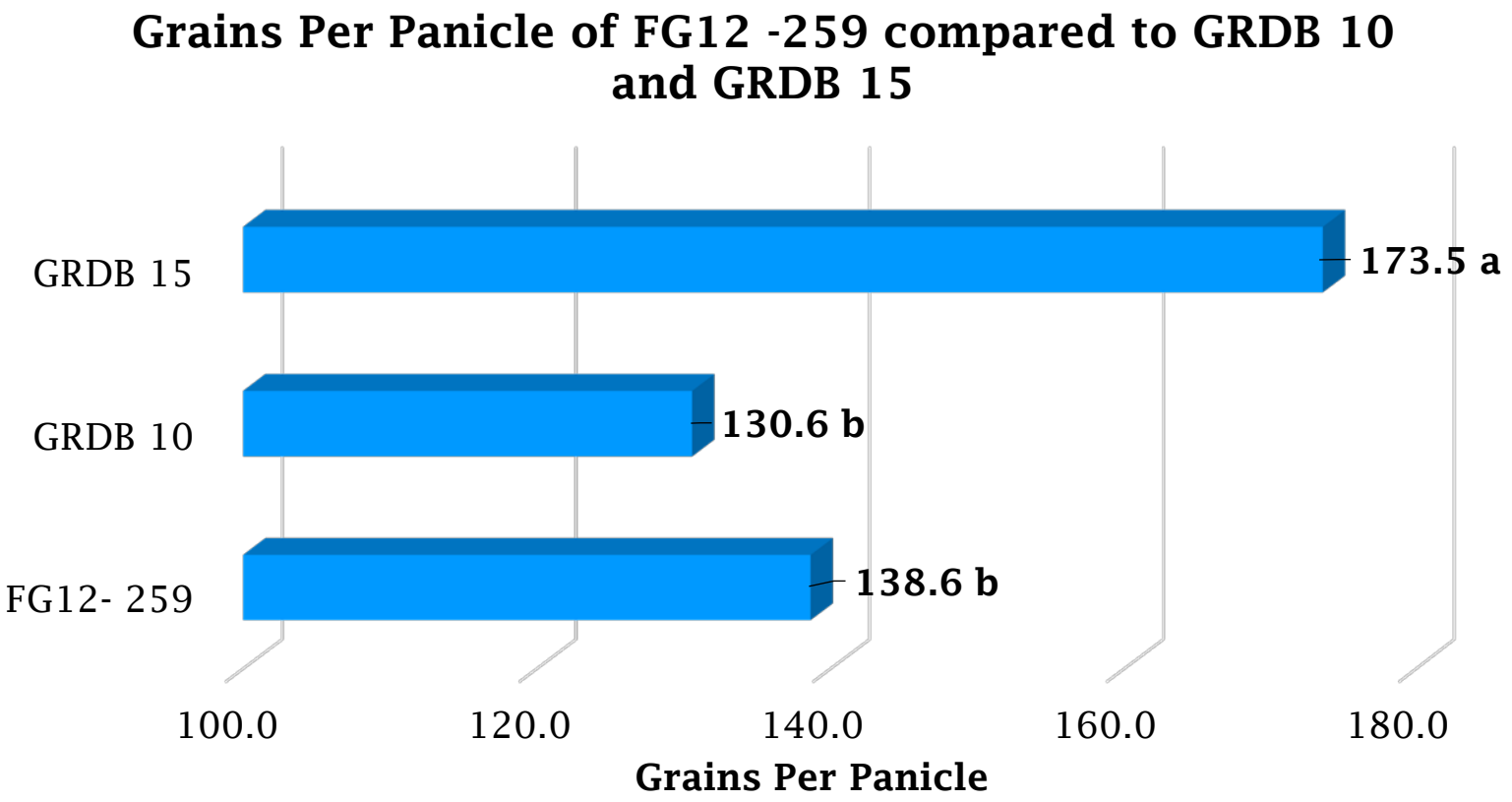
## Panicle Length




**FG12- 259: 25.8 cm compared to GRDB 10: 25.3 cm and GRDB 15: 23.3 cm**

# Yield Trial

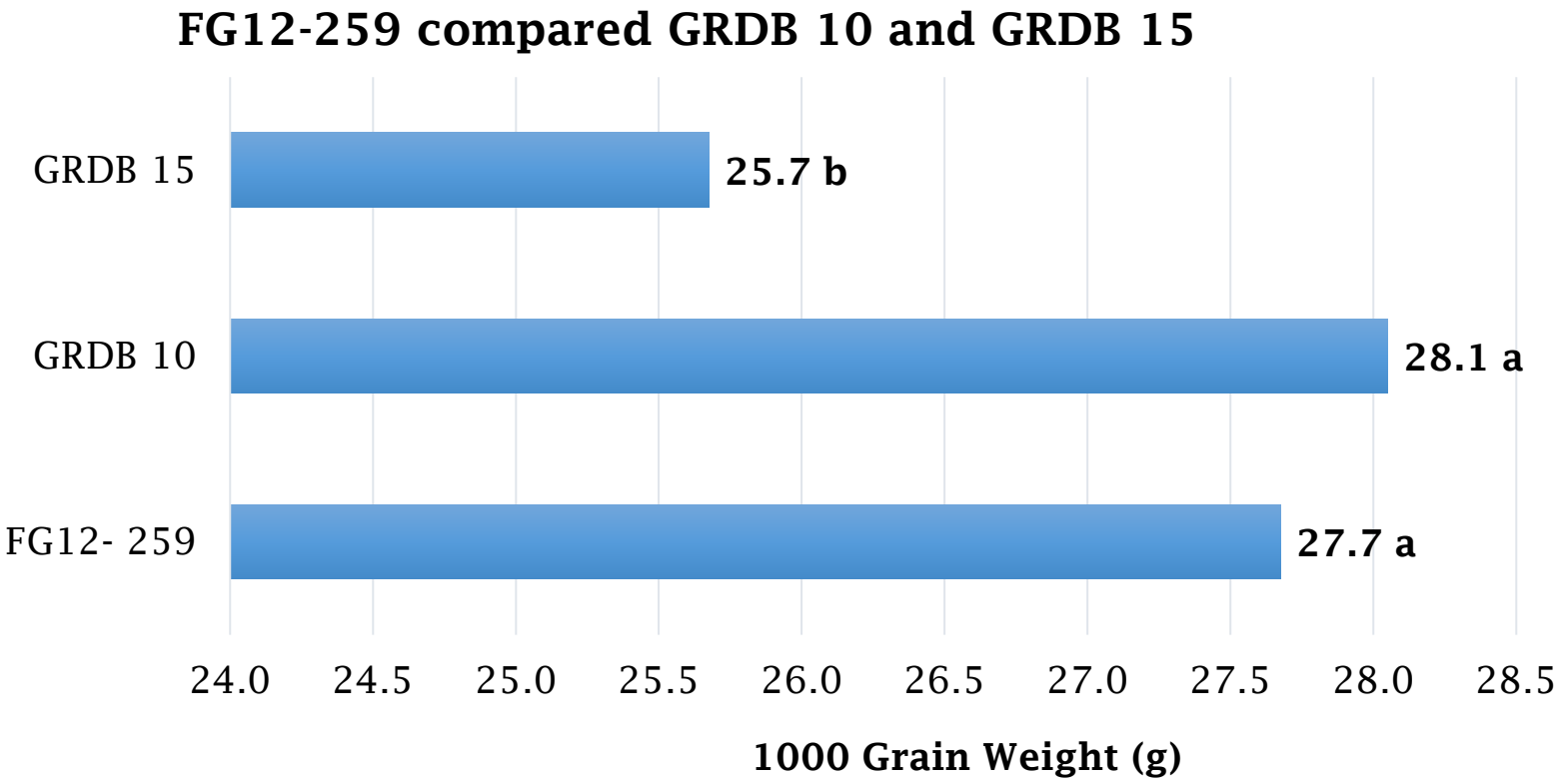
## Grain Per Panicle




**FG12- 259: 139 grains compared to GRDB 10: 130.6 grains and GRDB 15: 173.5 grains**

# Yield Trial

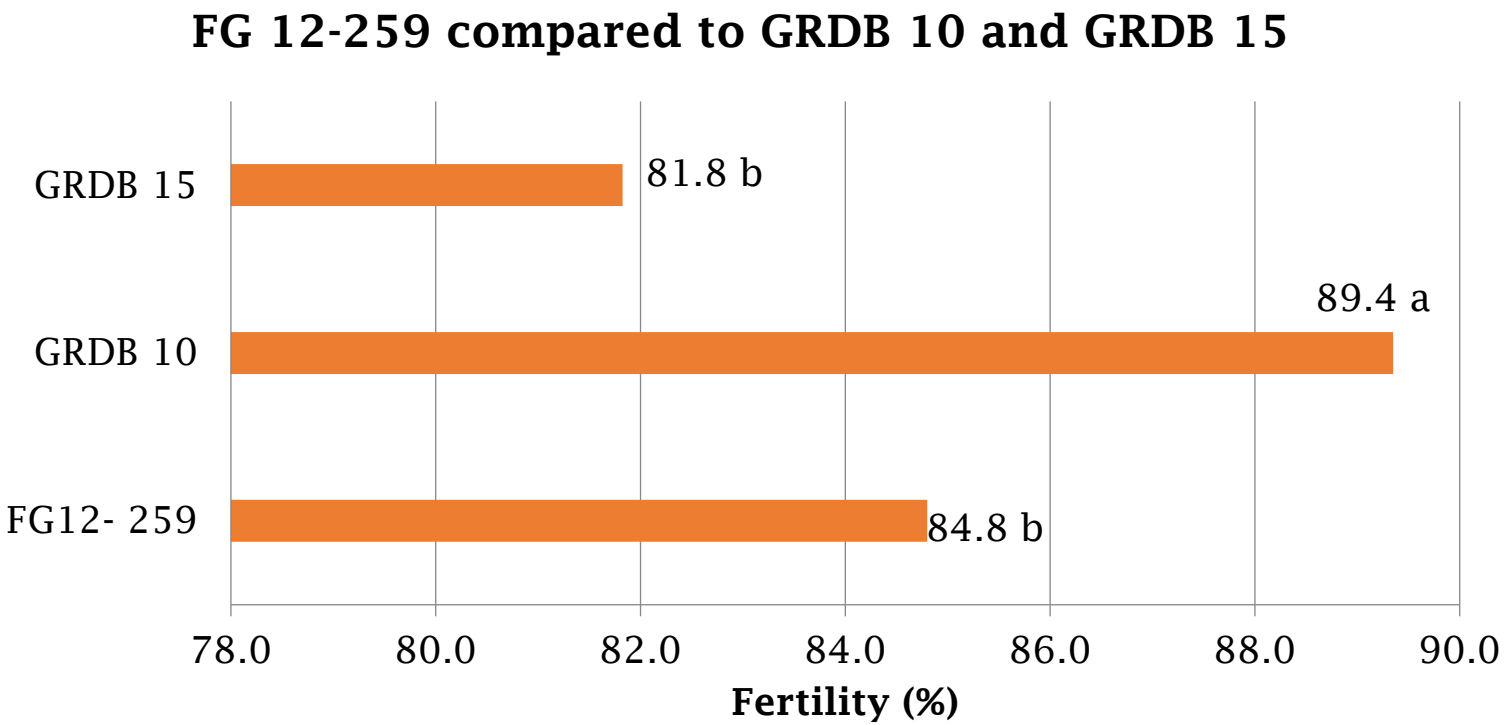
## 1000 Grain Weight




**FG12- 259 - 27.7 g compared to GRDB 10 - 28.1 g and GRDB 15 - 25.7 g**

# Yield Trial

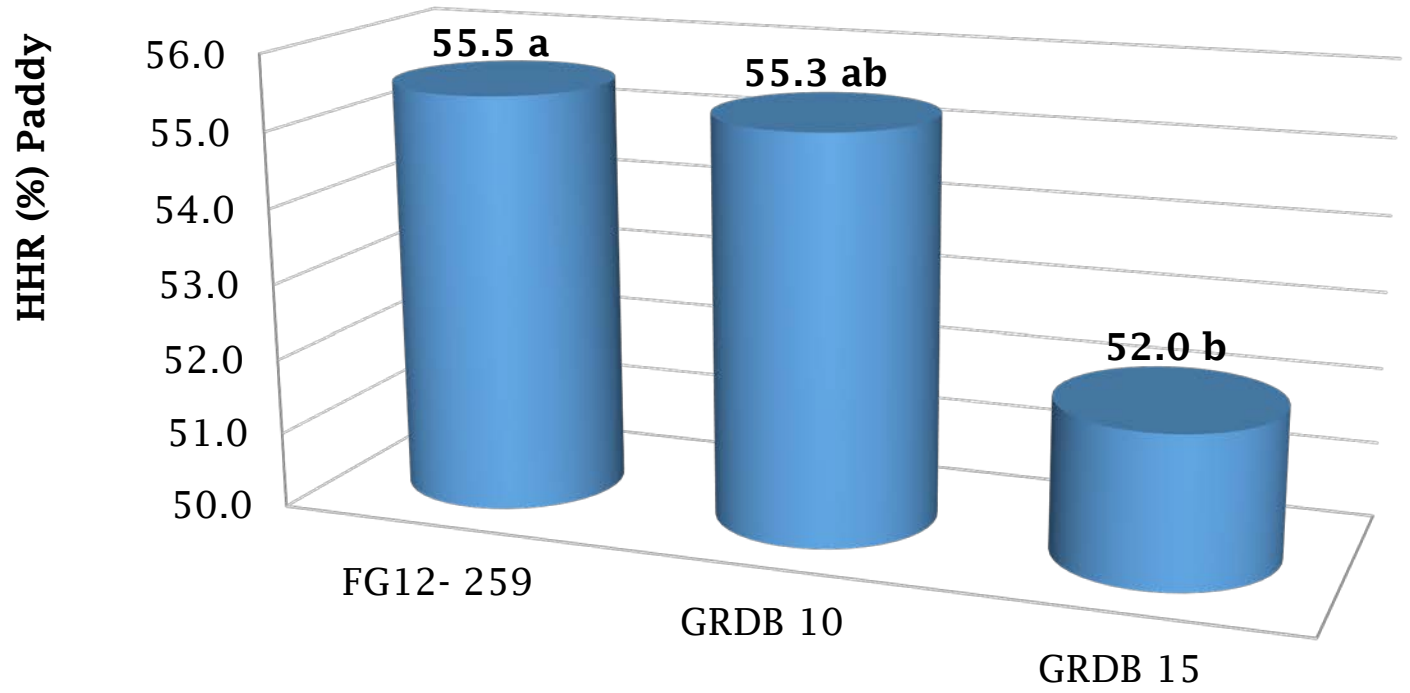
## Spikelet Fertility




**FG12- 259: 84.8% fertility compared to GRDB 10: 89.4% and GRDB 15: 81.8%**

# Yield Trial

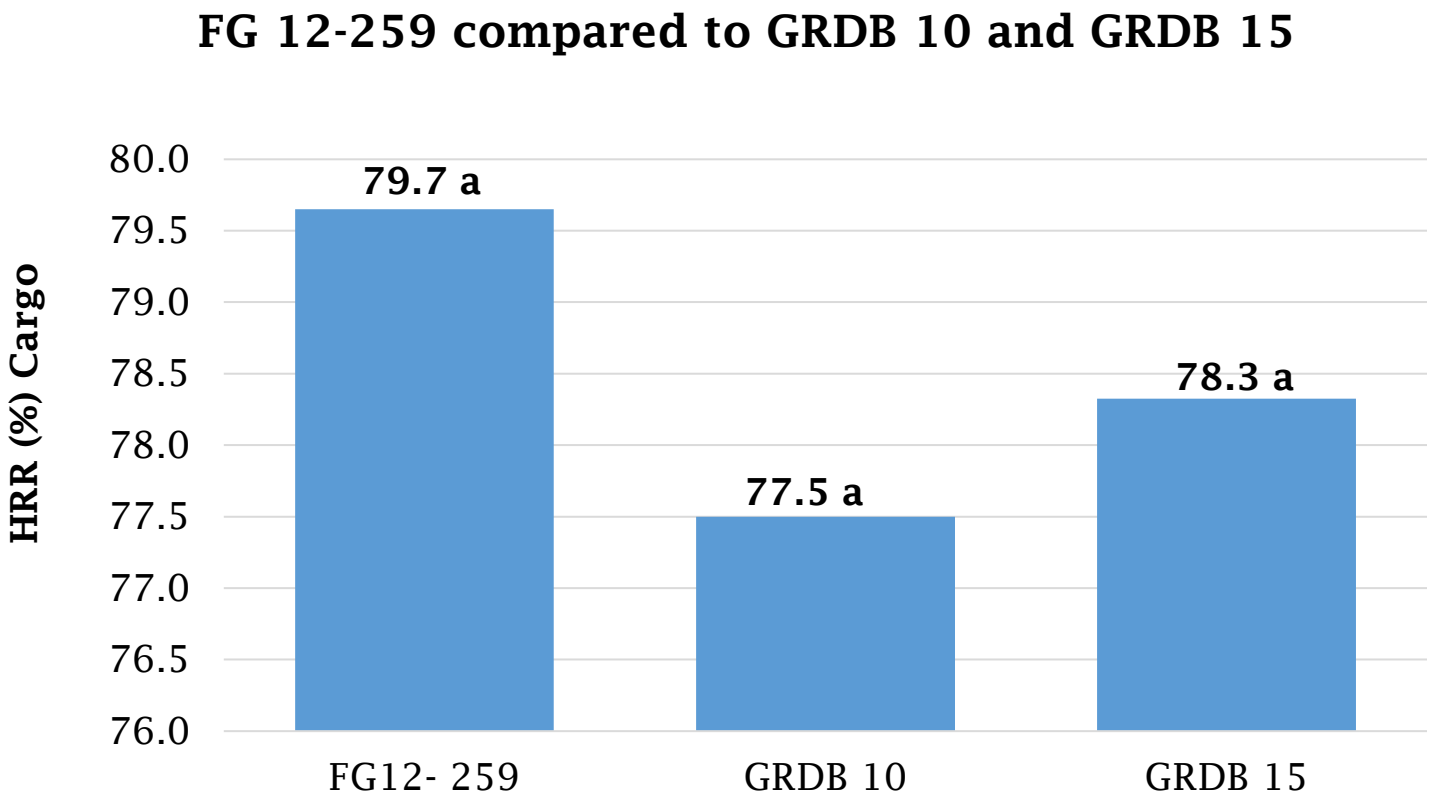
## Head Rice Recovery from Paddy (%)




**FG12- 259 - 55.5% compared to GRDB 10 - 55.3% and GRDB 15 - 52.0%**

# Yield Trial

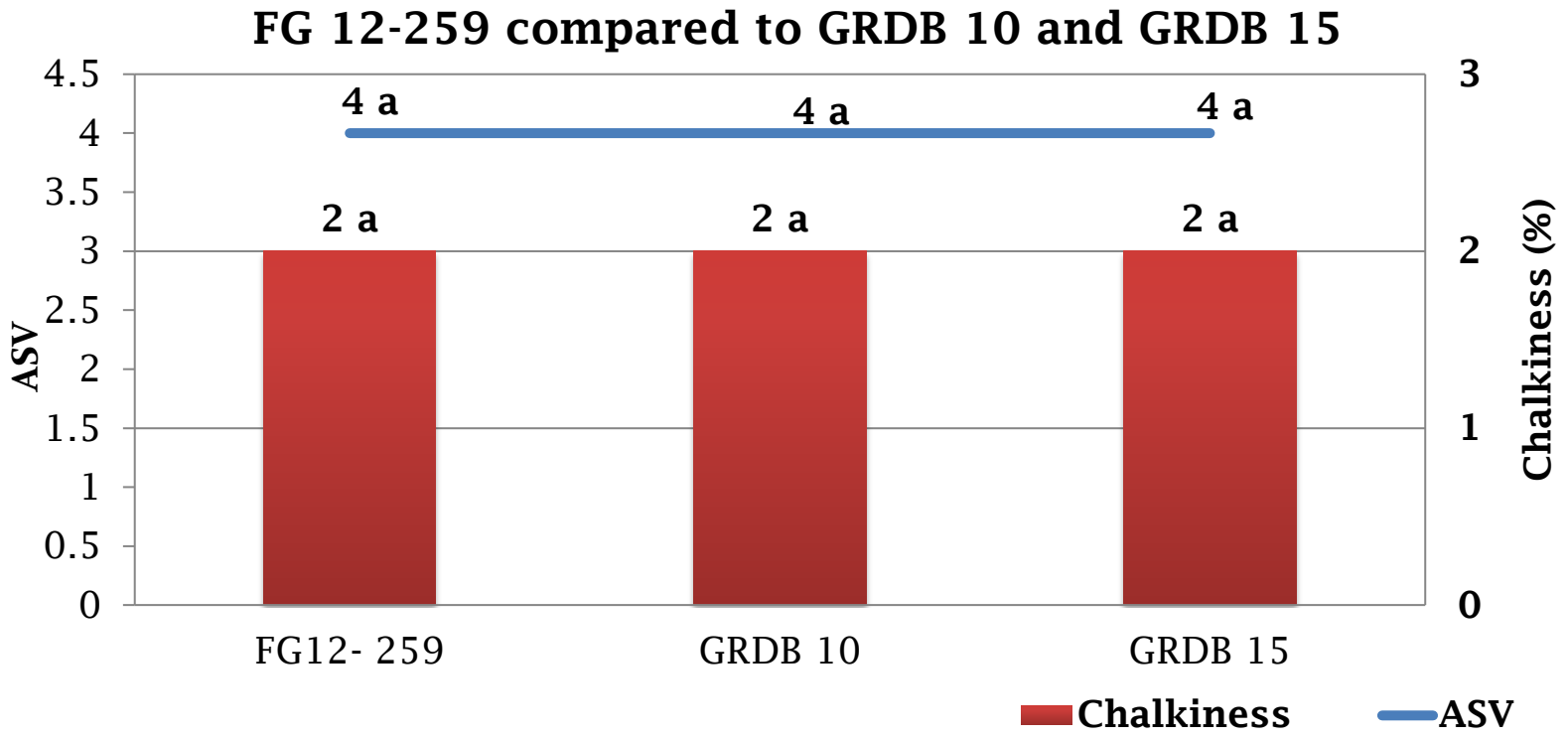
## Head Rice Recovery from Cargo (%)




**FG12- 259 - 79.7% compared to GRDB 10 - 77.5% and GRDB 15 - 78.3%**

# Yield Trials

## Chalkiness (%) and Alkaline Spreading Value




FG12- 259 and check were similar in both parameter

# Characteristics of FG12-259

## Characterization according to SES for Rice

| Agronomic and Morphologic | |
|---|---|
| Seedling Vegetative Vigour(Vg) | Extra vigorous |
| Tillering Ability (Ti) | Low (5 - 7) |
| Culm Strength (Cs) | Moderately Strong |
| Leaf Senescence (Sen) | Intermediate |
| Leaf Length (LL) | 50 cm |
| Leaf Width (LW) | 12 mm |
| Leaf Blade Pubescence (LBP) | Pubescence |
| Leaf Blade Colour (LBC) | Dark Green |
| Basal Leaf Sheath Colour (BLSC) | Green |
| Leaf Angle (LA) | Erect |
| Flag Leaf Angle (FLA) | Erect |

# Characteristics of FG12-259

| Agronomic and Morphologic | |
|---|---|
| Ligule Length (LgL) | 18 mm |
| Ligule Colour (LgC) | White |
| Ligule Shape (LgS) | Cleft |
| Collar Colour (CC) | Light Green |
| Auricle Colour (AC) | Light Green |
| Culm Length (CL) | 90.6 cm |
| Culm Number (CN) per plant | 7 |
| Culm Angle (CmA) | Erect (<30°) |
| Diameter of Basal Internode (DBI) | 5.6 mm |
| Culm Internode colour (CmIC) | Green |

# Characteristics of FG12-259

| Agronomic and Morphological | |
|---|---|
| Panicle Type (PnT) | Intermediate |
| Secondary Branching of Panicles (PnBr) | Absent |
| Panicle Axis (PnA) | Slightly Drooping |
| Panicle Exertion (Exs) | Well exerted |
| Panicle Treshability (PT) | Easy |
| Spikelet Fertility (SpFert) | Fertile (86%) |
| Phenotypic Acceptability (PAcp) | Excellent |
| Awning (An) | Short and partly awned |
| Awn colour (AnC) | Straw |

# Characteristics of FG12-259

| Agronomic and Morphological | |
|---|---|
| Apiculus Colour (ApC) | Straw |
| Stigma colour (SgC) | Yellow |
| Lemma and Palea colour (MPC) [Grain Colour] | Straw |
| Lemma and Pubescence (LmPb) | Short hairs |
| Sterile Lemma Colour (SLmC) | Straw |
| Sterile Lemma Length (SLmL) | Medium |
| Days to Flowering | 75 - 78 |
| Days to complete Flowering | 80- 83 |
| Dormancy (Days) | 0-7 |
| Harvest Index (HI) | 42% |

# Characteristics of FG12-259

| Disease | |
|---|---|
| Blast (Pyricularia grisea) | Resistant to Highly Resistant |
| Brownspot (Cochliobolus miyabeanus (Bipolarisoryzae, Drechsleraoryzae). | Moderately Resistant |
| Sheath Blight (Thanethoporuscucumeris, Rhizoctonia solani) | Moderately Resistant |
| Sheath Rot (Soracladium oryzae) | Moderately Resistant |

# Characteristics of FG12-259

| Grain | |
|---|---|
| Grain Length (GrL) | 10.0-11.0 (mm) |
| Grain Width (GrW) | 2.6-2.7 (mm) |
| Brown Rice Length (BrLn) | [7.8mm ± 0.3]<br>(Long to Extra Long) |
| Brown Rice Width (BrW) | 2.3 ±0.05 (mm) |
| Brown Rice Shape (BrS) | Slender (over 3.0) |
| White Rice Length (WrLn) | 7.20 ± 0.3 (mm) |
| White Rice Width (WrW) | 2.0 mm |
| 1000 Grain Weight (GW) | 28-30 (g) |

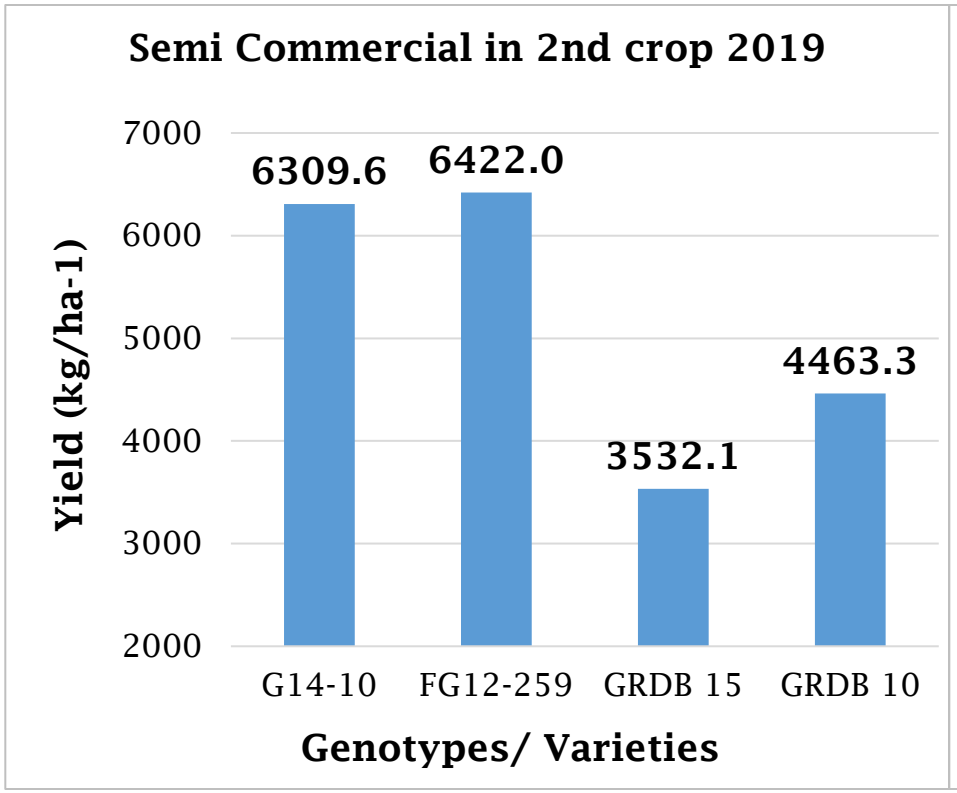
# Characteristics of FG12-259

| Grain Qualities | |
|---|---|
| Chalkiness (Clk) | 2.0 (%) Small |
| Head Rice Recovery (HRR)- Paddy | 58.0 ± 3.0 (%) |
| Total Rice Recovery (TRR)- Paddy | 69.0 (%) |
| Head Rice Recovery (HRR)- Brown | 82.0 (%) |
| Total Rice Recovery (TRR)- Brown | 88.0 (%) |
| Grain Expansion- Length (GEL) | 75.21 (%) |
| Grain Expansion- Width (GEW) | 67.17 (%) |
| Cooking Time (White rice) | 15-18 mins |
| Cooking Time (Parboiled) | 18-20 mins |
| Alkali Spreading Value (ASV) | 4 |

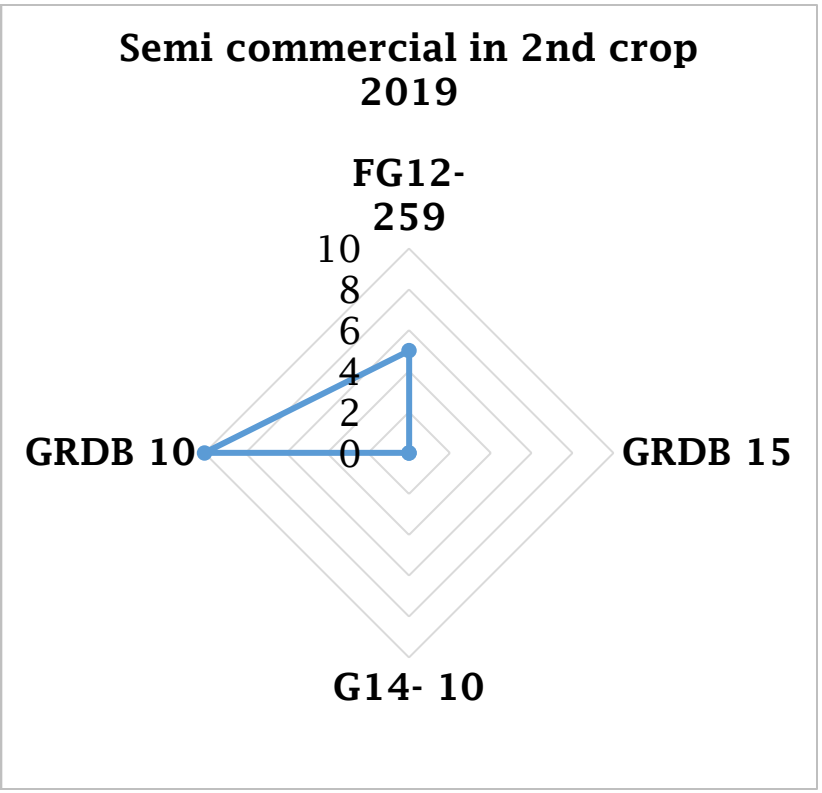
# Semi-Commercial Testing

(2nd crop 2019)

## Grain Yield



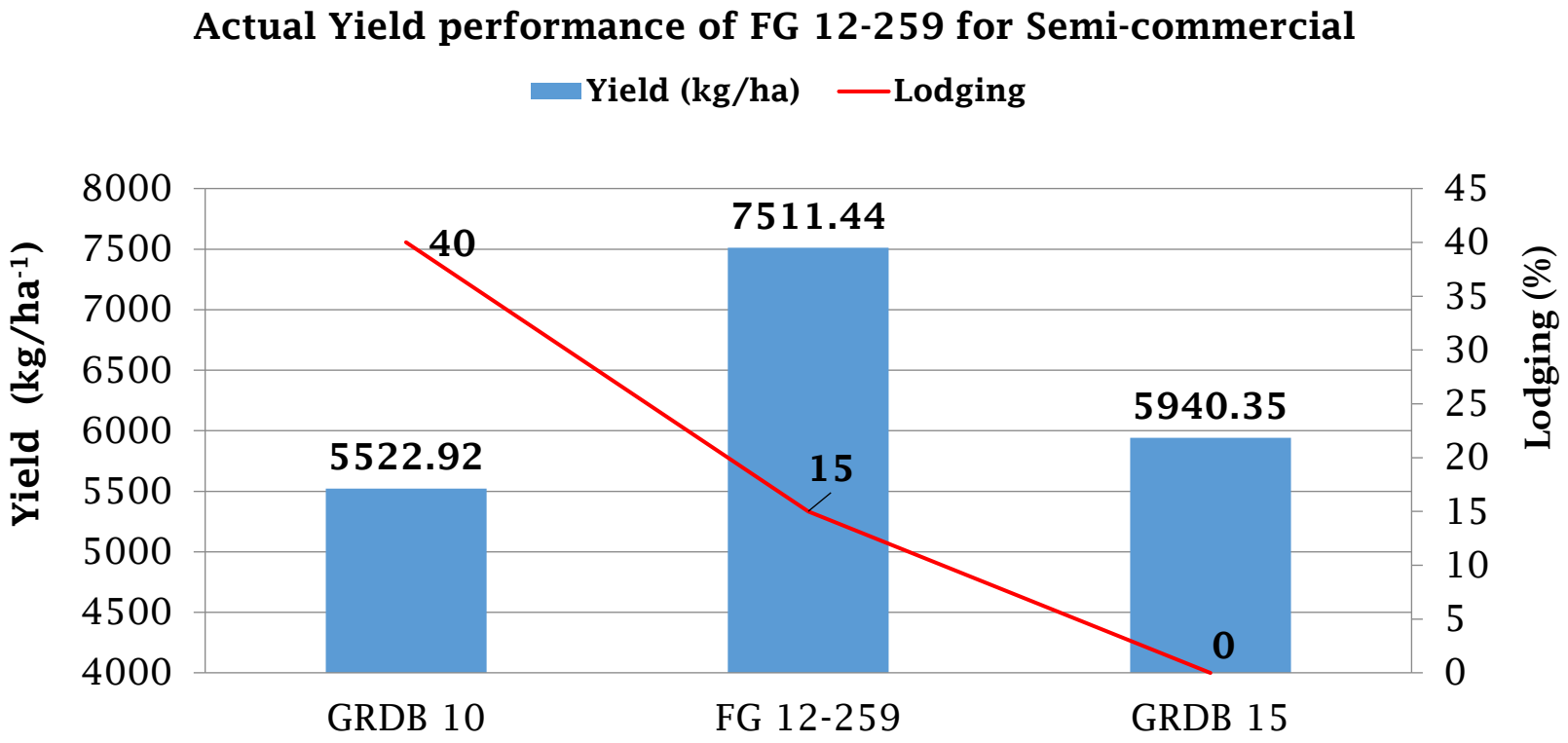

## Lodging Tendency



# Semi-Commercial

(1st crop 2020)

## Grain Yield and Lodging Tendency




*FG12- 259 obtain a Yield advantage of 1771.1 kg/ha-1 and 1988.6 kg/ha-1 from GRDB 10 and GRDB 15 respectively. FG12- 259 recorded 25% less Lodging compared GRDB 10 and 15% more than GRDB 15*

# On Farm Trial

**Spring 2020:**

- **Locations/Farmers :30**
- **Plot Size :100 $m^2$**
- **Check -GRDB 10 and GRDB 15**

**Autumn 2020:**

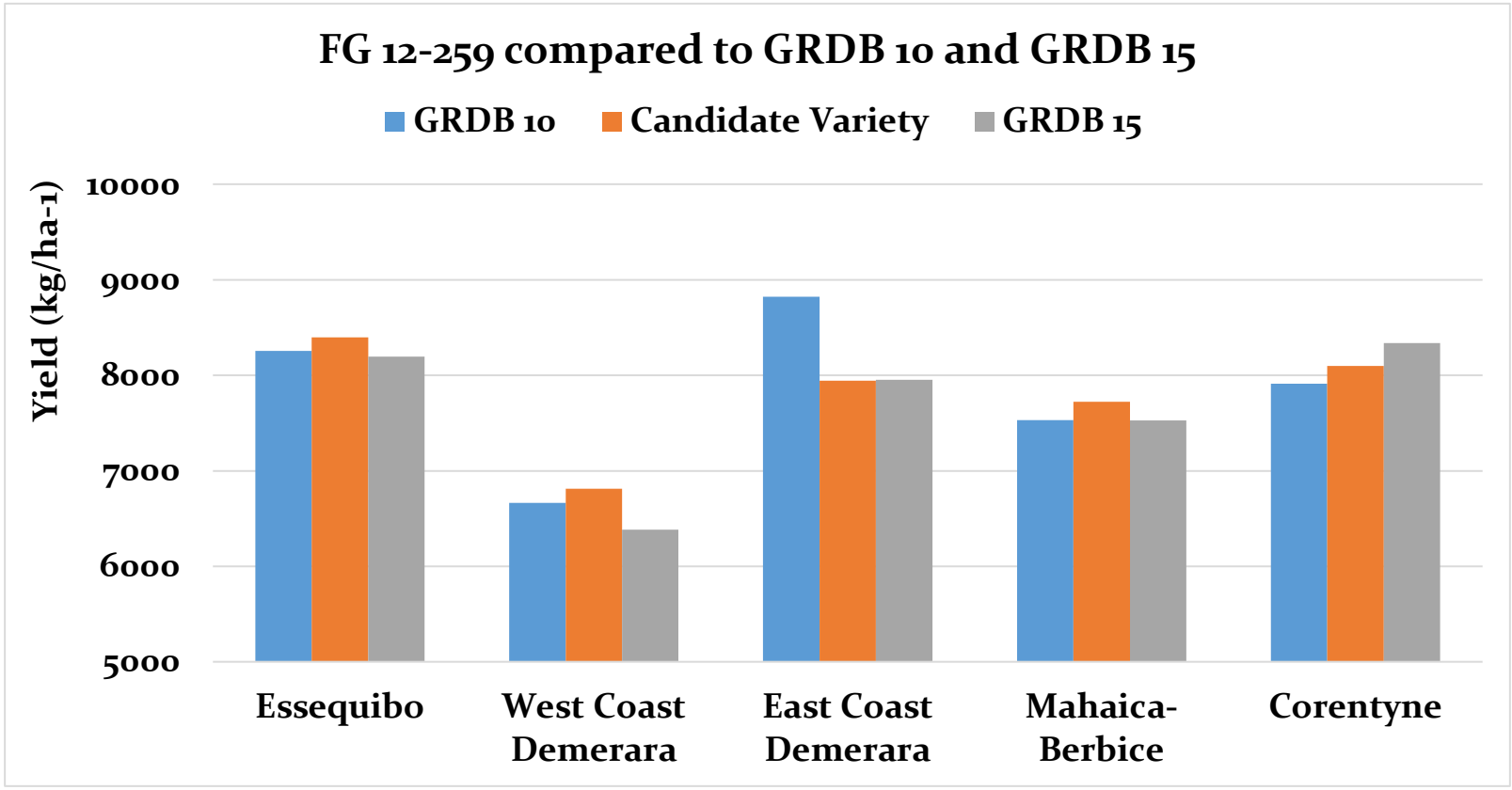
- **Locations/Farmers - 30**
- **Plot Size :0.6- 2.4 ha**

| SN | Region | Farmers | Location |
|---|---|---|---|
| 1 | 2 | Rafeek Khan | Anna Regina |
| 2 | 2 | Ramnaresh Ramnauth | Hibernia |
| 3 | 2 | Deoram Prahalad | Fairfield |
| 4 | 2 | Harry Narain | Dry Shore |
| 5 | 2 | Kaydar Persaud | Relliance |
| 6 | 3 | Yodendra Sahdeo | Wakenaam |
| 7 | 3 | Ramjas Lakram Singh | Leguan |
| 8 | 3 | Mohamed Fiazal Baijyasin | Orangestein |
| 9 | 3 | Ganga Persaud | Hague |
| 10 | 3 | NICIL | Wales |
| 11 | 4 | Anthony Sebastian | Hope, East Coast, |
| 12 | 4 | Rayad Bacchus | Cane Grove |
| 13 | 4 | Khemraj Persaud | Unity, Mahaica |
| 14 | 5 | Shamsundar Ramrup | De Hoop |
| 15 | 5 | Carl Singh | MMA main-Abary River |
| 16 | 5 | Mohamad Rafeodeen | MMA, Hopetown |
| 17 | 5 | Sasenarine Persaud | Perseverance |
| 18 | 5 | Brijdat Ramnarace | Letter T Village |
| 19 | 5 | Alfread Crawford | Onverwagt |
| 20 | 5 | Jeetendra Persaud | Mahicony, Creek |
| 21 | 5 | Tulla Persaud | Bath Settlement |
| 22 | 5 | Vayrendra Seenarine | Cotton Tree Village |
| 23 | 5 | Fair Field Investment limited | Fair field |
| 24 | 5 | Rohan Odit | Weldad, WCB |
| 25 | 5 | Fiead Subhan | Bush Lot |
| 26 | 6 | Leekh Rambridge | Bengal Farm |
| 27 | 6 | Karmanand Basdeo | Black Bush Polder |
| 28 | 6 | Lakhnarayan Rootharan | Crab Wood Creek |
| 29 | 6 | Hemraj Permal | Whim |
| 30 | 6 | Rashid Ali | # 70 Corentyne |

# On Farm Trial

1st Crrop,2020

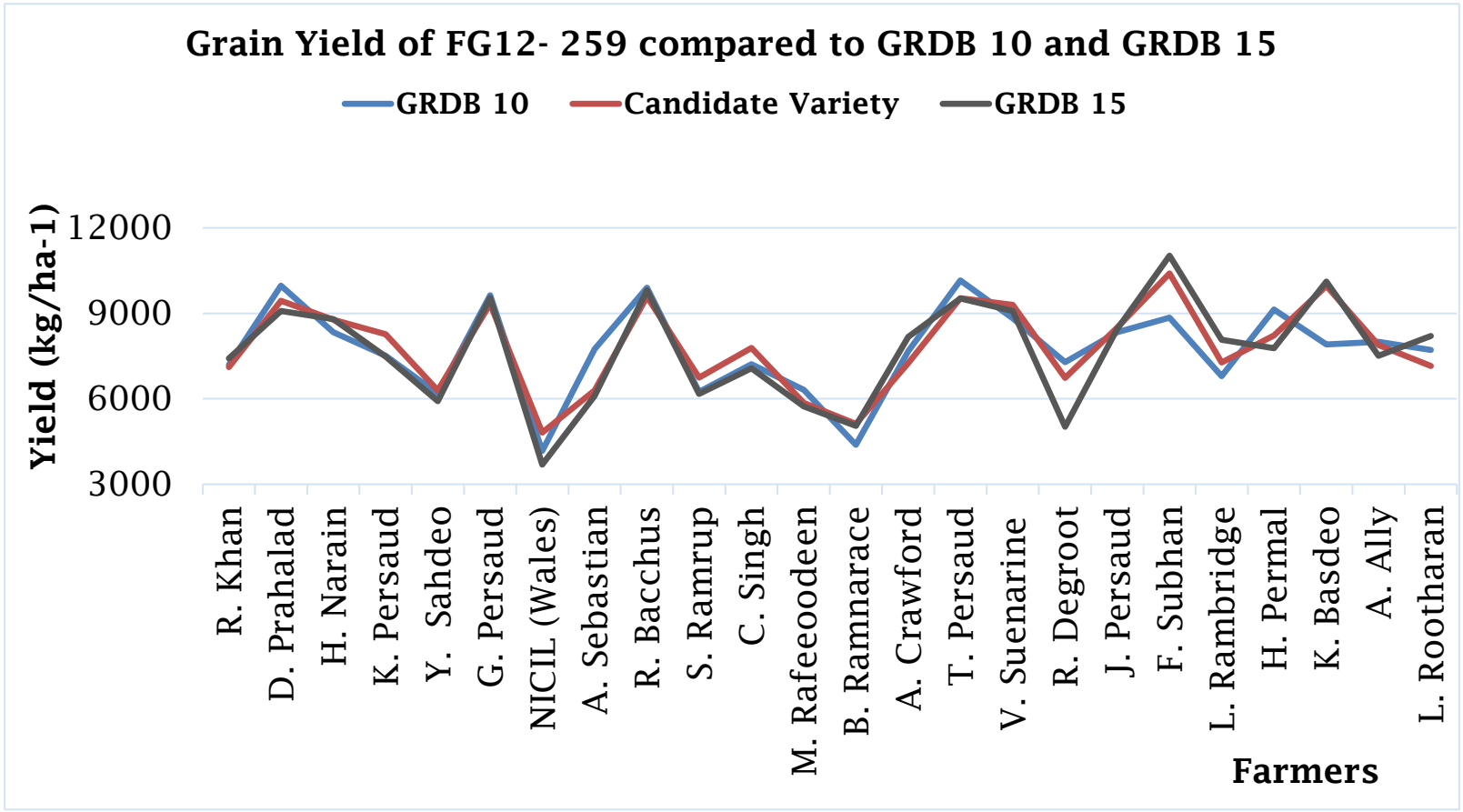
## Grain Yield Performance in the different regions



# On Farm Trial

1st Crrop,2020

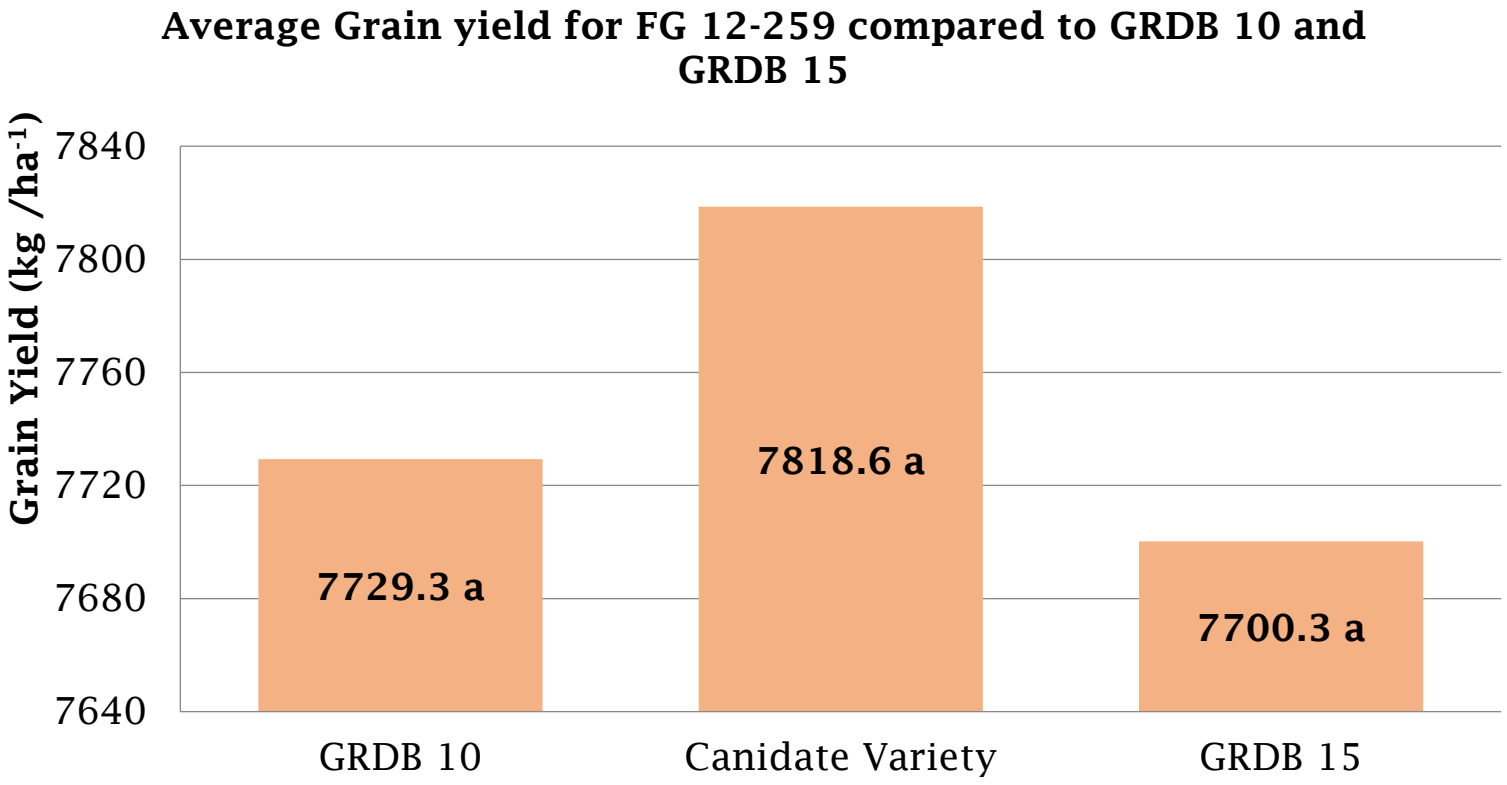
## Grain Yield for the different Farm/Location



# On Farm Trial

1st crop, 2020

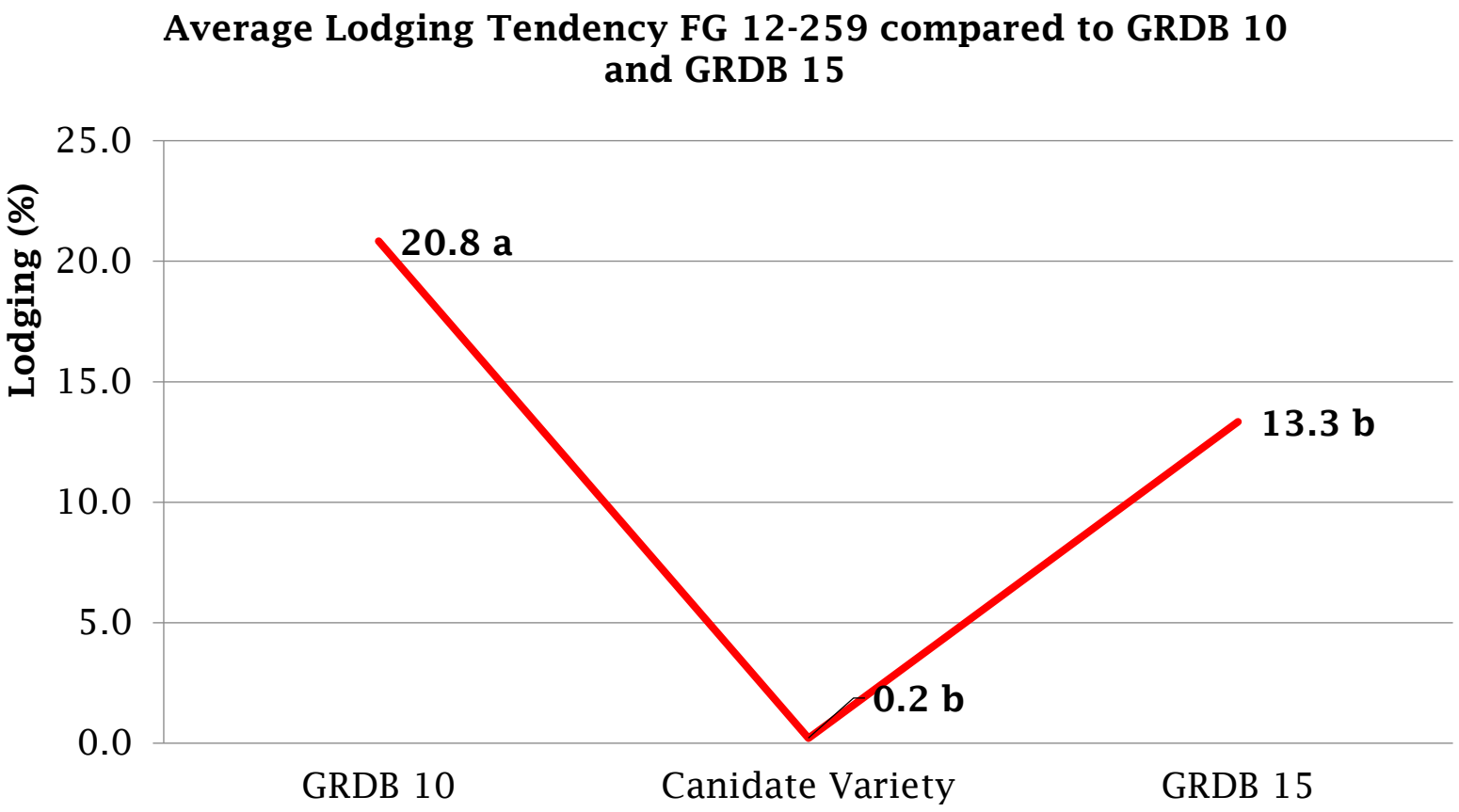
## Average Grain Yield




**FG12- 259 yielded 118.3 kg/ha$^{-1}$ more than GRDB 15 and 89.3 kg/ha$^{-1}$ more than GRDB 10.**

# On Farm Trial

## Lodging Tendency

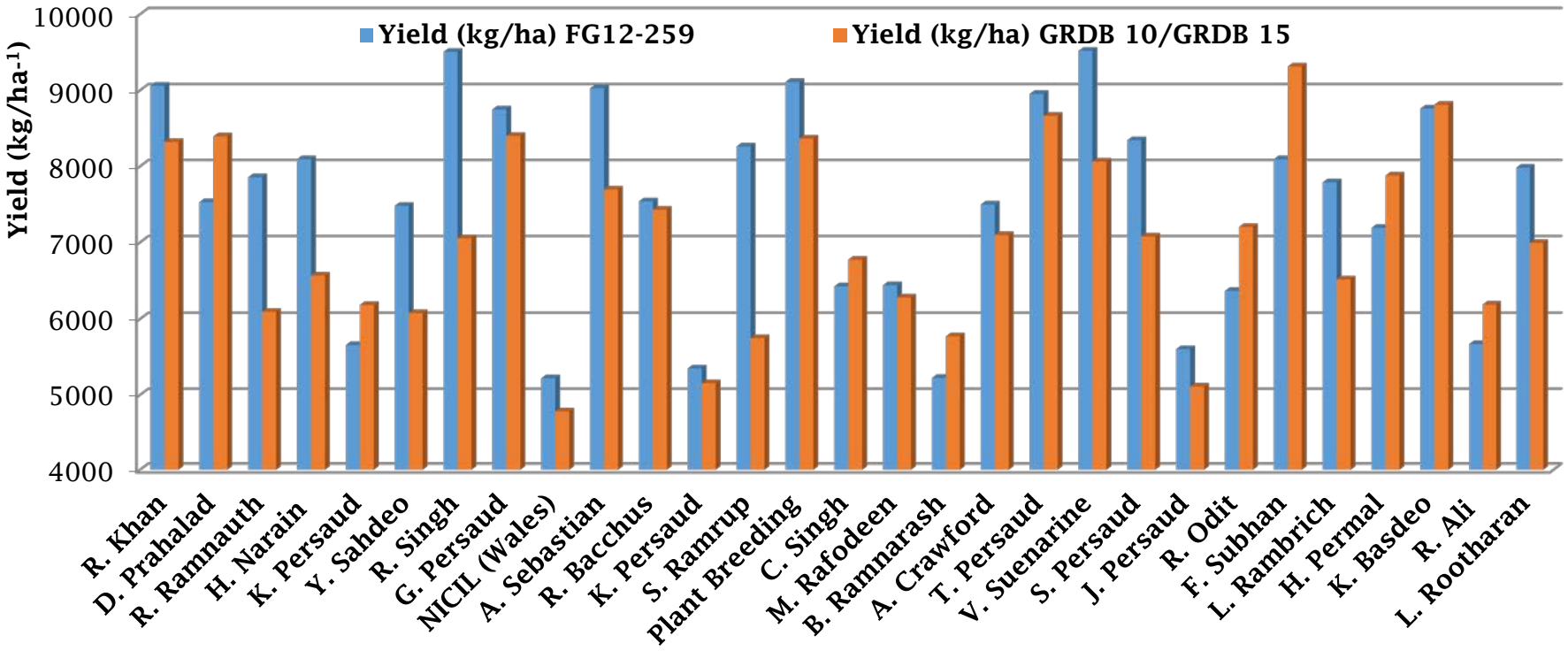


# On Farm Trial

## 2nd Crop, 2020

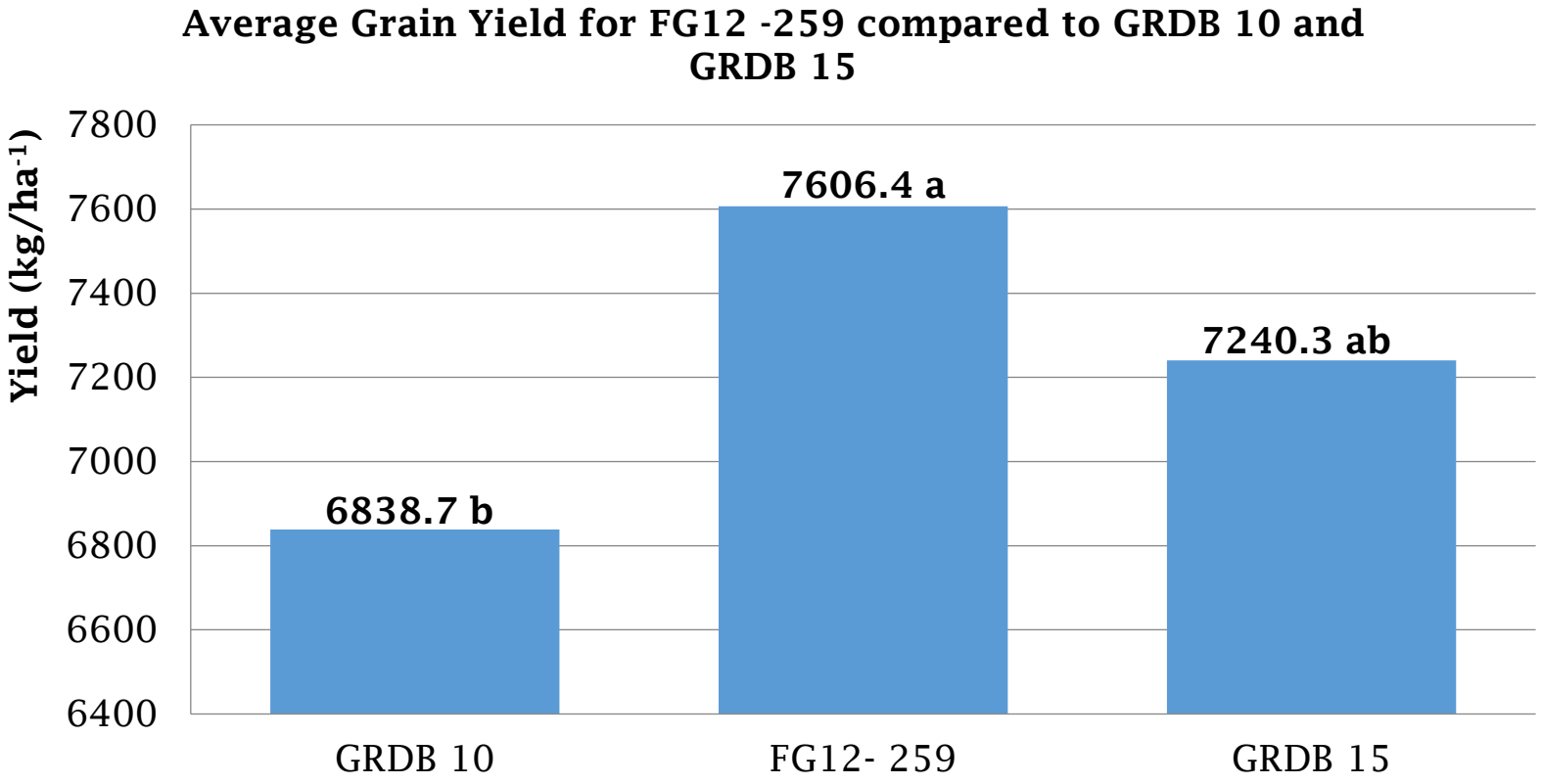
## Grain Yield per Farm in 2nd crop 2020

### FG 12-259 compared to GRDB 10/GRDB 15



# On Farm Trial

## Average Grain Yield in 2nd crop 2020

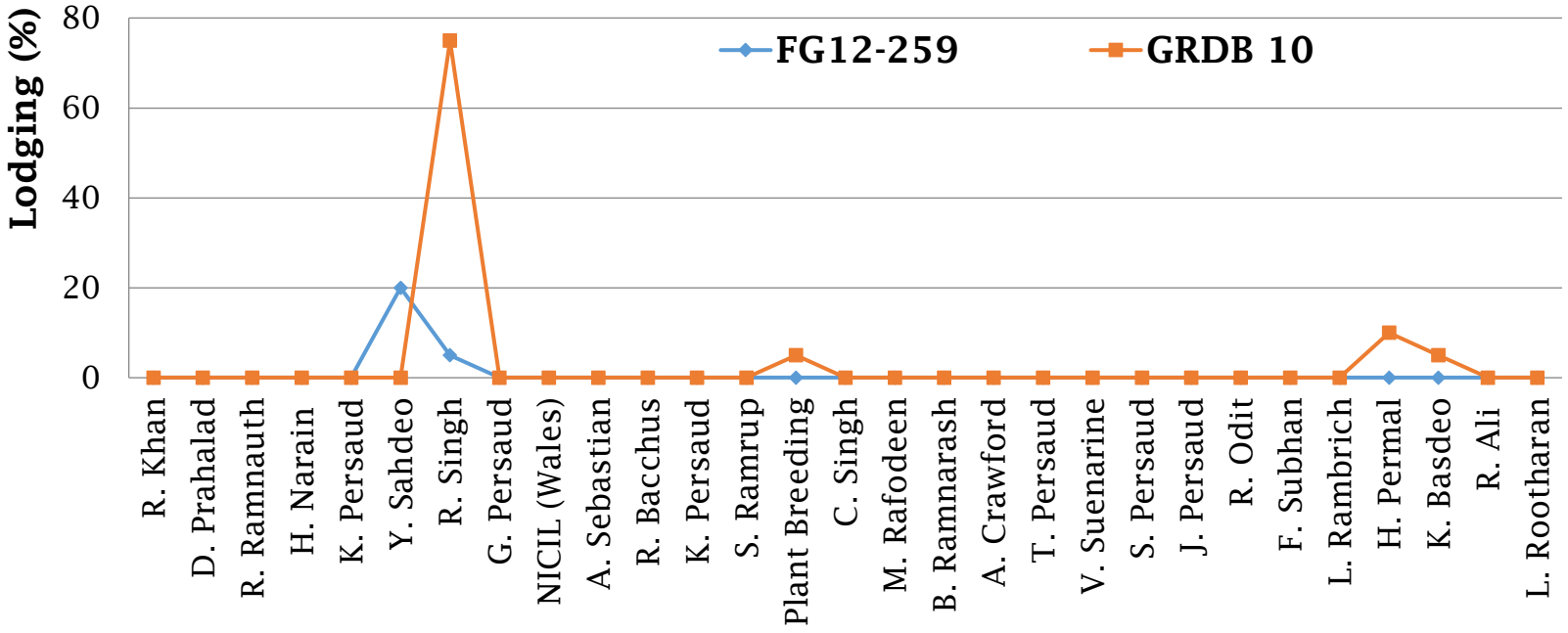



**Difference 767.7 kg/ha$^{-1}$ (4.8 bags/ac) more than GRDB 10 and 366.1 kg/ha$^{-1}$ (2.3 bags/ac) GRDB 15**
**FG12- 259 is significantly higher than GRDB 10**

# On Farm Trial

## Lodging Tendency in 2nd crop 2020

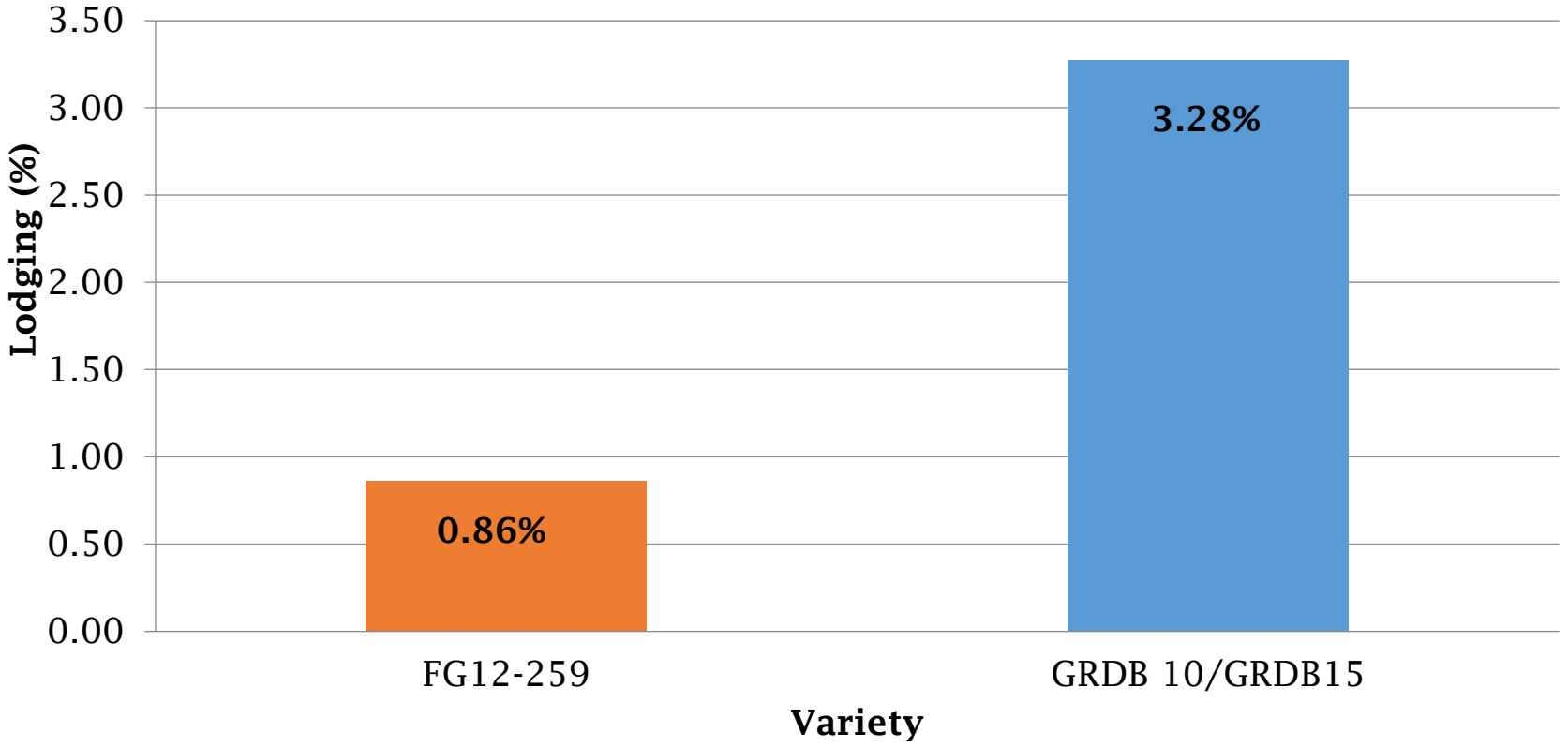
### FG 12-259 compared to GRDB 10/GRDB 15



# On Farm Trial

## Average Lodging Tendency in 2nd crop 2020

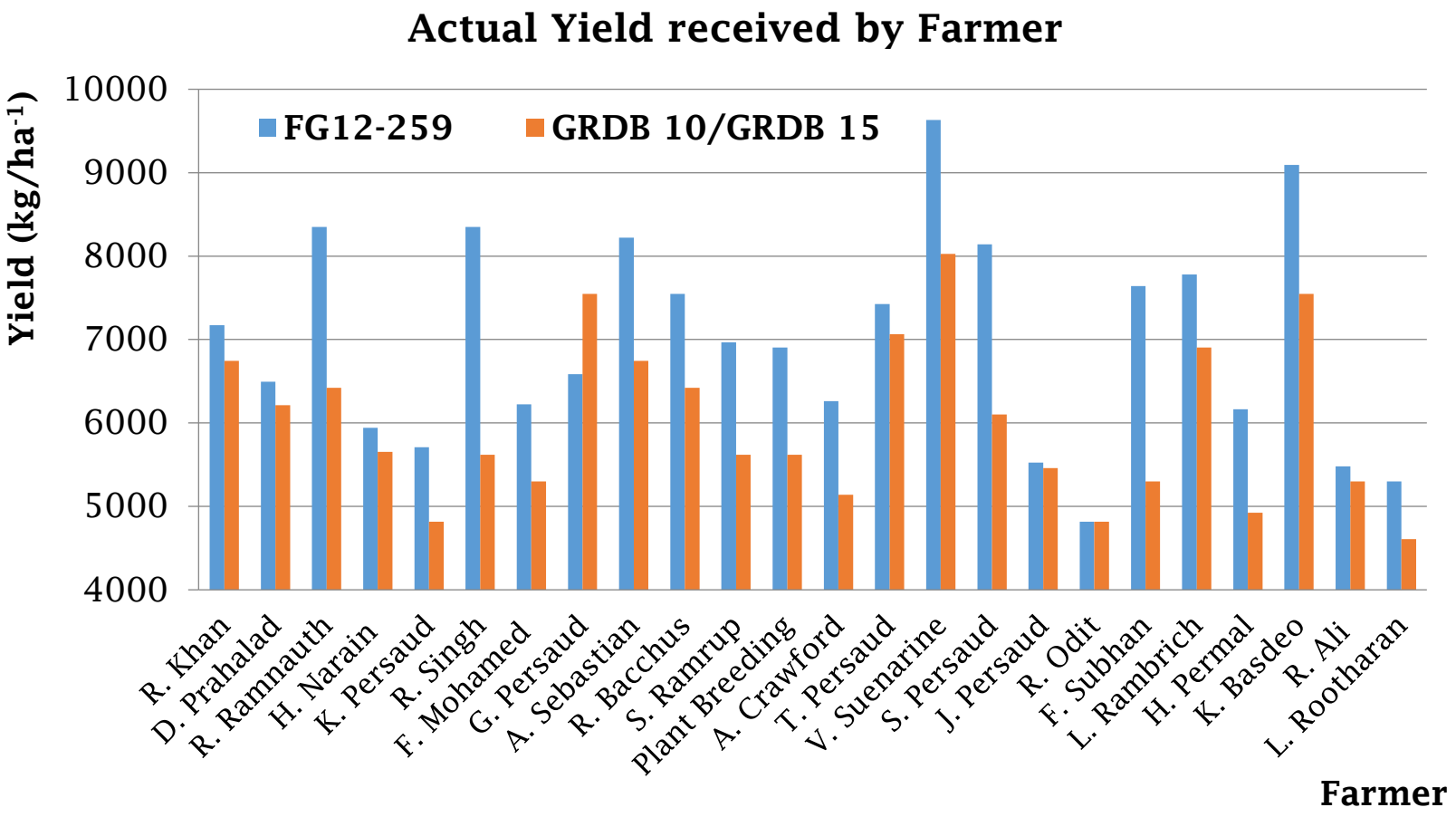
### FG12- 259 compared to GRDB 10/GRDB 15




**FG 12-259 obtain 2.42% lodging tendency less than GRDB 10/GRDB 15**

# On Farm Trial

## Actual Grain Yield for 2nd crop 2020




FG12-259: ranged 4816.5 kg/ha-$^{1}$ to 9633.0 kg/ha-$^{1}$ (30 to 60 bags/ac) avg. 6988.0 kg/ha-$^{1}$ (43 bags/ac).
Check ranged 4607.8 to 8027.5 kg/ha-$^{1}$ (30 to 50 bags/ac) , avg. of 5995.6 kg/ha-$^{1}$ (37 bags/ac)

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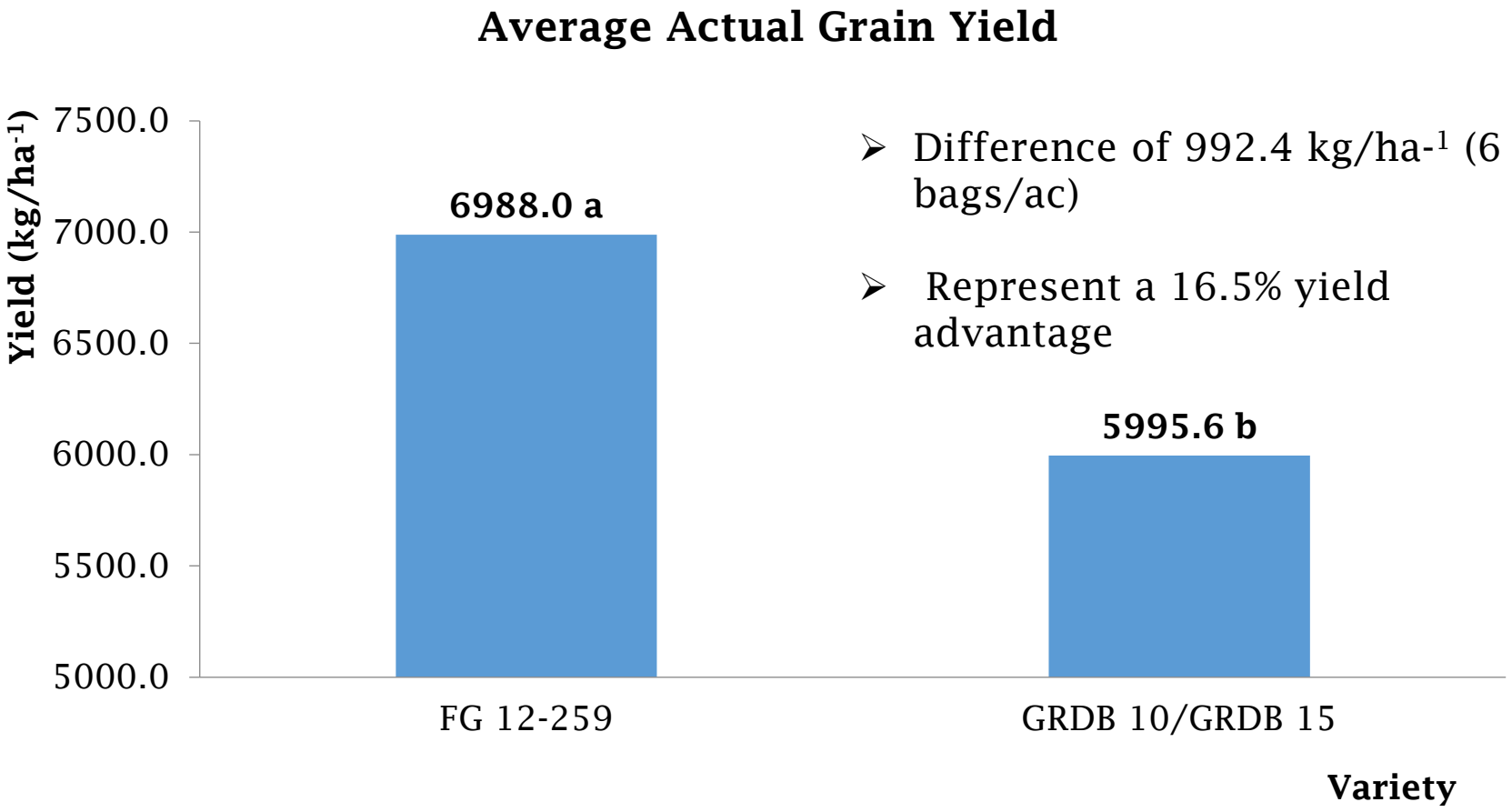
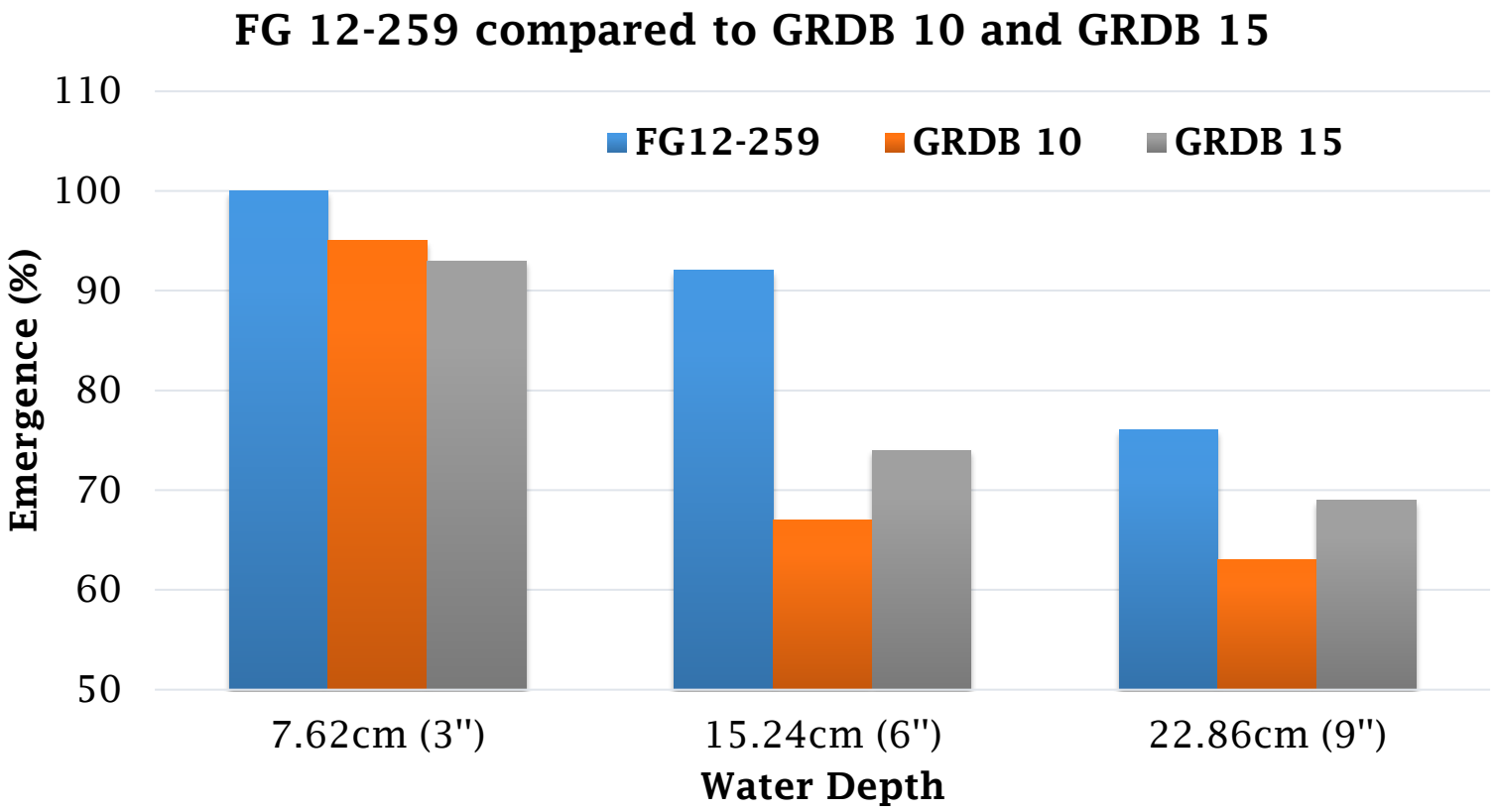



- Difference of 992.4 kg/ha-1 (6 bags/ac)
- Represent a 16.5% yield advantage

# Other Studies

## i. Seedling emergence during Autumn crop 2020




**FG 12-259 is better than the GRDB 10 and GRDB 15 at all three depths, this is really an advantage for the farmers.**

# Other Studies

## ii. Seeding Density Evaluation

A seed rate of 112.3 kg $ha^{-1}$ (100 lbs. per ac) is recommended for the cultivation of FG12-259.

## iii. Evaluation of NPK Levels

A fertilizer input of 100 kg N $ha^{-1}$, 40 kg $P_2O_5$ $ha^{-1}$ and 40 kg $K_2O$ $ha^{-1}$ is recommended for the cultivation of FG12-259.

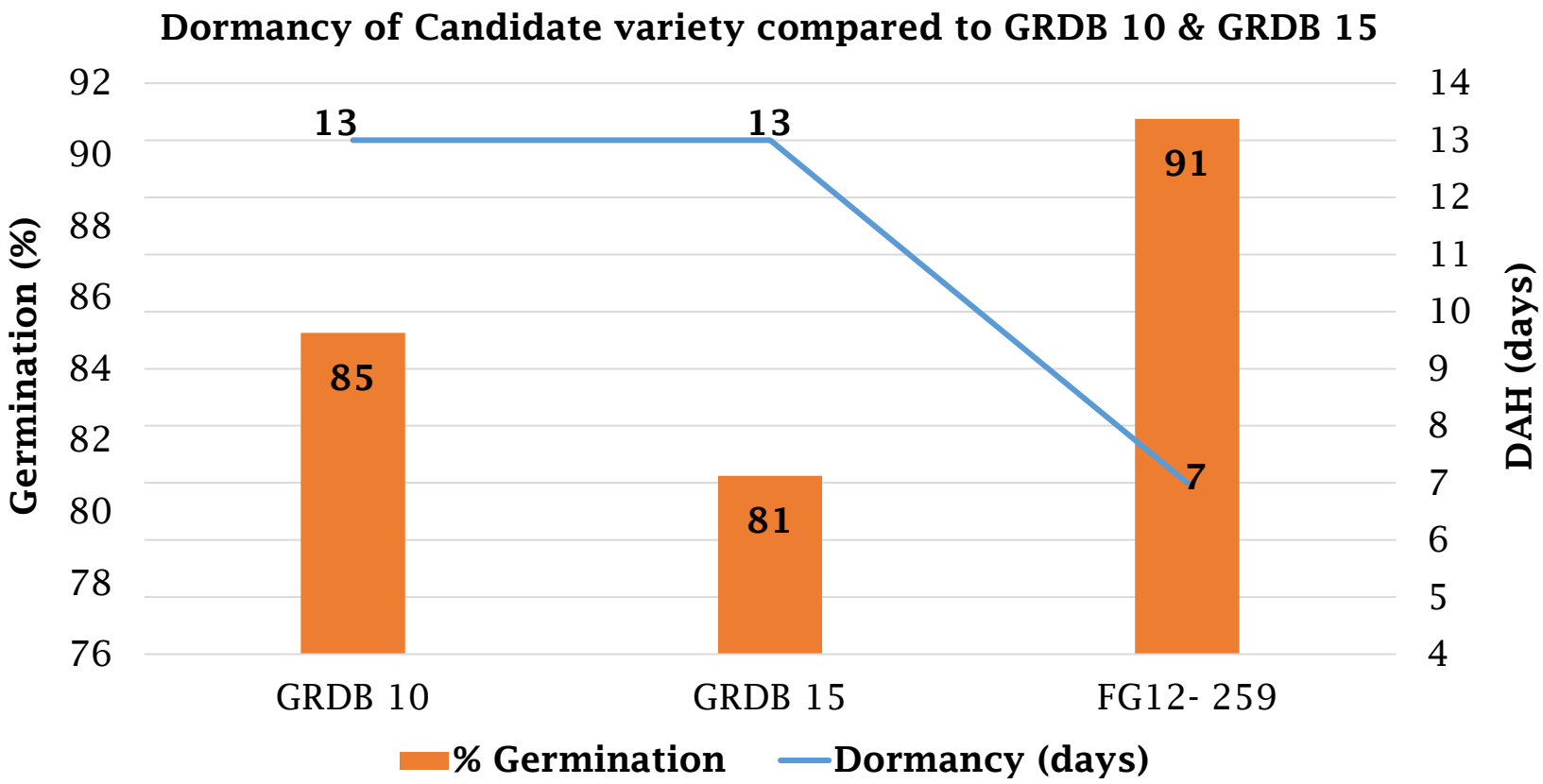
# Other Studies

## iv. Bulk Density of Grains


**FG12-259 indicated 8.5% higher bulk density for compared to GRDB 10 and GRDB 15.**

# Other Studies

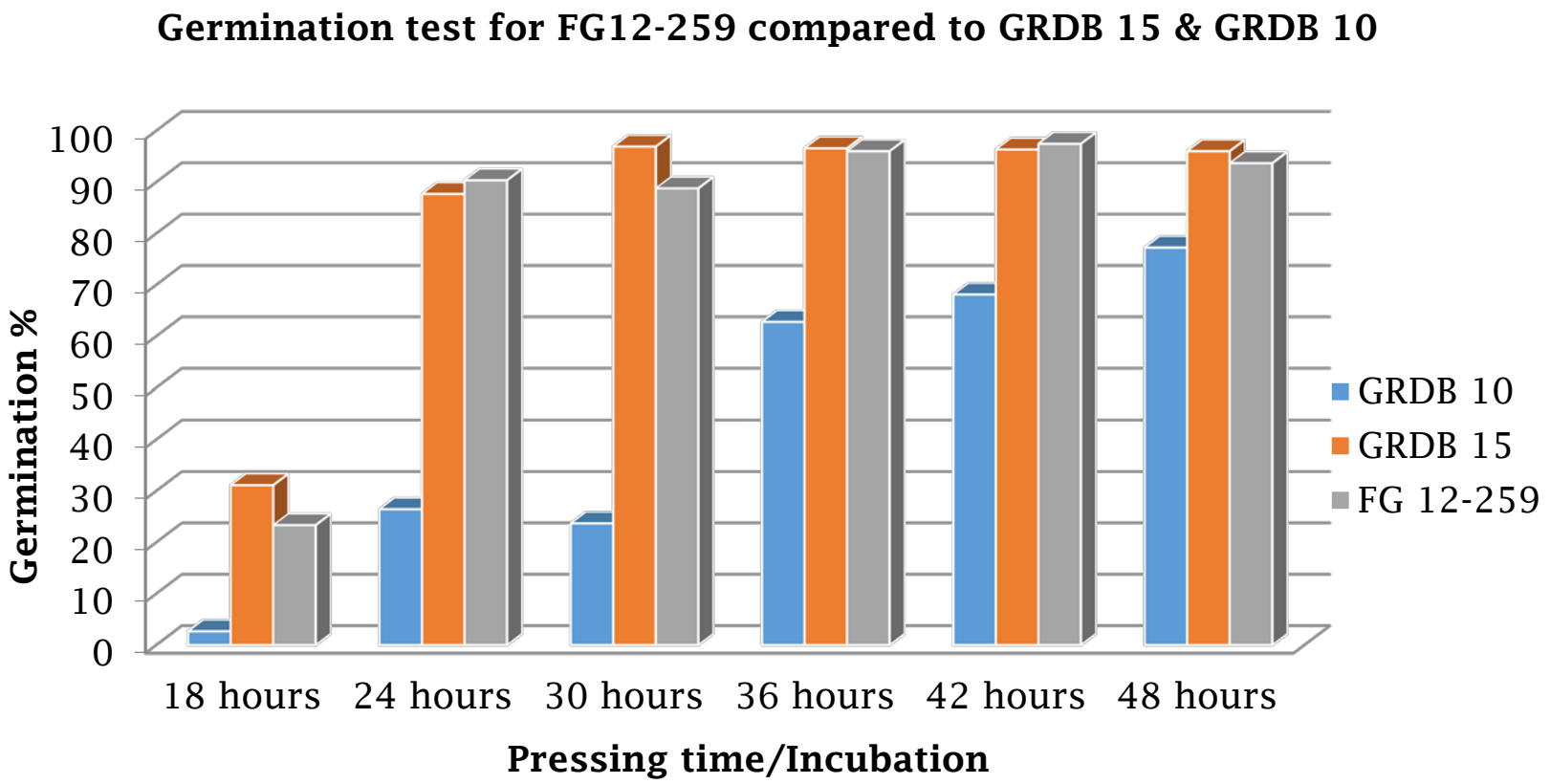
## v. Dormancy




**FG12- 259 showed >80% germination 7 DAH as compared with GRDB 10 & GRDB 15 with 13 DAH**

# Other Studies

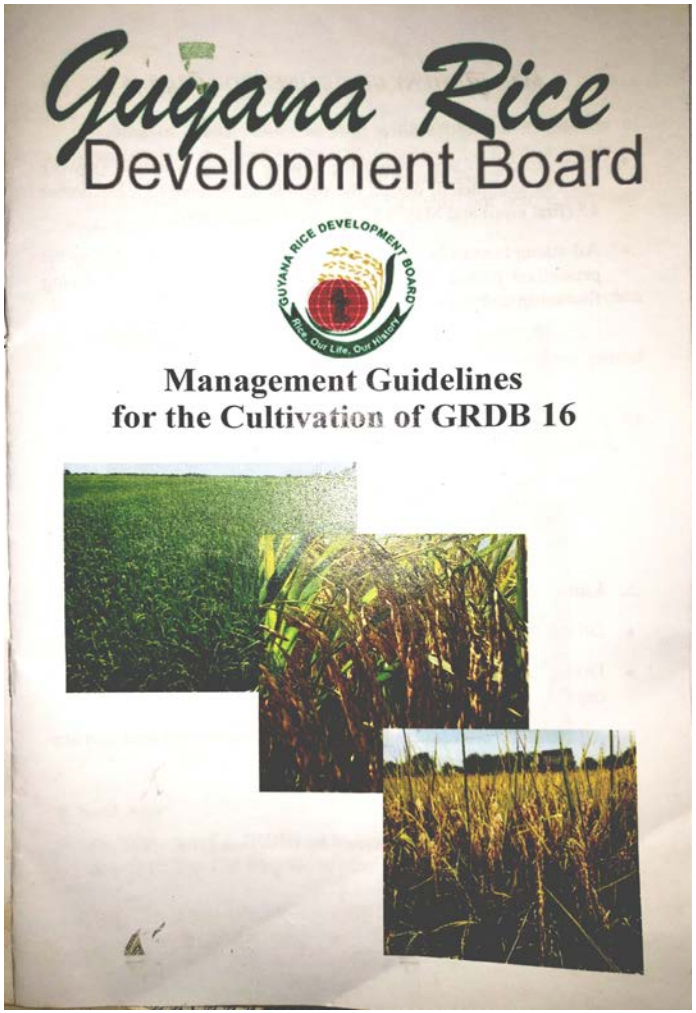
## vi. Soaking and Incubation period




**It is recommended that FG12- 259 be soaked for 24 hours and incubated/ pressed for 24 hours to gain excellent germination.**

# Management Guidelines (Brochure)

- *Synchrony of Sowing*
- *Land Preparation*
- *Seed Source Seed Treatment*
- *Germination*
- *Seed Rate*
- *Water Management*
- *Weed Management*
- *Nutrient Management*
- *Disease Management*
- *Pest Management*
- *Roguing*
- *Harvesting*



# OFT Farmer Response

**All the farmers that participated in the OFT over the two seasons were extremely satisfied with the performance of the strain in their fields.**

**Some of the key observations were:**

- Excellent germination and vigour under field conditions
- Ability to grow through flooded conditions
- The plants canopy and covers the land well
- Plants maintain a dark green color throughout the crop
- Strong plant type and no lodging
- Good tolerance to delayed harvesting
- Panicle remains at the top which makes it easy for paddy bug control
- Grains are very heavy
- The panicle has very little 'wind grain'(sterile grains)
- Early maturing
- Better yield performance over GRDB 10 and GRDB 15

# Farmers Response: interactive sessions

- A series of interactive sessions were conducted with the farmers who participated in the trials and their neighboring farmers, during the Second crop 2020 in the major rice growing regions (regions 2, 3, 4 - 5 and 6) at around harvesting time.
- These interactions were very encouraging where farmers registered their likeness for the candidate variety and are requesting seeds for their farm for the first crop 2021.

# Seed Supply

- The Guyana Rice Development Board, Rice Research Station (RRS) maintains the genetic purity of the new varieties and produces Basic and Certified seeds for further multiplication.
- The Candidate variety seems very uniform in its characters.
- The RRS could make available to farmers approximately 900 bags high quality seed stock (200 bags basic and 700 certified seeds).
- Another 3,500 bags will be harvested from On-farm trials during the Second crop 2020 and made available to the farmers.
- Thus, a total of 4,400 bags of the candidate variety would be available for sowing in the first crop 2021.

# Conclusions

- Early duration (110-112 days), Blast resistant, semi dwarf rice variety.
- Emerge well from 7.6 cm to 15.2 cm (3-6 inches) of standing water in the field.
- A strong and thick culm (stem) coupled with slow leaf senescence.
- It is better able to tolerate lodging (< 10 %) as compared to the GRDB 10 (approx. 30%) and GRDB 15 (approx. 5%).

# Conclusions

- Genetic potential to produce even higher yields as demonstrated with grain yields up to 9.6 t/ha (60 bags/ac) in a farmer field during the second crop 2020 - On Farm Trials.
- Produced grain with a significantly higher bulk/volume density compared to the popular varieties.
- Excellent milling and cooking qualities.
- The new genotype will provide greater genetic diversity.

# Recommendation

Based on the performance of candidate variety in all evaluations conducted over the years and response given by farmers it is recommended for release for commercial cultivation in Guyana as '**GRDB FL 16**' for the spring (first) crop 2021.

# Persons Involved in Developing FG12-259

- Mahendra Persaud -Plant Breeder
- Edgar Corredoer -Plant Breeder
- Eduardo Graterol -Plant Breeder
- Nandram Gobind -Research Assistant, Breeding
- Violet Henry -Research Assistant, Breeding
- Munindra Seeraj -Research Assistant, Breeding
- Jairam Persaud -Sr. Research Technician, Breeding
- Naitram Persaud -Sr. Research Technician, Breeding
- Elijah Adams -Sr. Research Technician, Breeding
- Miranda Henry -Scientist, Breeding
- Jasmin Jacobs -Technician, Breeding
- Shevon Sharp -Technician, Breeding
- Jamal Europe -Technician, Breeding
- Ms. Narita Singh -Value Added/Post Harvest
- Gansham Payman -Agronomist
- Rajendra Persaud -Pathologist
- Viviane Baharally -Entomologist
- Danata Mc Gowan -Scientist Pathology/Breeding
- Mr. Nizam Hassan -Manager General/Marketing
- Ms. Allison Peters - Manager Quality/Research
- Mr. Bissessar Persaud -Extension Manager
- Dr. Oudu Homenauth -CEO, NAREI


Thank You Very Much