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The U.S. Government's Global Hunger & Food Security Initiative

Provided Target Product Profiles

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The U.S. Government's Global Hunger & Food Security Initiative

Bangladesh Rice

Provided by: Bangladesh Rice Research Institute



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Trait Value	Trait Value Descriptors	Gene Frequency in Program
1	1-“Nice to Have” are traits that are sometimes appreciated a limited segment of the market but in general the traits very little economic impact across the broader market. Nice to have traits have the least economical value.	Program is actively working with trait
2	2-Must Have Trait or “Basic” Traits are required by the market. An variety could not compete in the market place without these traits. The are a trait that need to be incorporated into the variety.	Program has trait available
3	3-"Game Changer" or “Value Added” Traits are significant step-change traits that cause a radical shift in the market. Once the basic package is satisfied, these traits drive market acceptance. They are worth the most provided the basic trait need is satisfied.	Trait Limited or NOT available

Irrigated Rice Product Profiles

Country or Region: Whole Bangladesh		Selection Emphasis (%)	Market Leading Variety #1: BRRi dhan28		
Market Slot: Irrigated Rice (Medium slender to long slender grain)			Market Leading Variety #2: BRRi dhan29		
Traits	Key Traits		Trait Value	Bench Mark	Traits
Yield (Paddy)	Yield (10% higher)	40	2	BRRi dhan29	=> BRRi dhan29
Maturity	Intermediate	10	2	BRRi dhan28	135-145 days
Abiotic Stress	Cold (both stages)	10	2	HbjB.VI; Bhutan	SES =< 3
Biotic Resistance	Blast	10	3	Pi9, Pb1 and Pita	SES =< 3
Biotic Resistance	BLB	5	1	xa5, xa13, Xa21	SES =< 3
Biotic Resistance	BPH	5	1	BPH32, bph17	= Rathuhee-ti
Consumer Traits	Amylose	10	2	BRRi dhan28	= BRRi dhan28 (>= 25 %)
Yield -Head Rice	HR recovery	10	2	BRRi dhan28	= BRRi dhan28 (>=50%)

1= nice to have, 2= must have traits, 3= game changer

Salinity (Boro) Breeding Product Profiles (20% Breeding Program Focus)

Country or Region: Salt affected coastal region and/Whole Bangladesh		Resource allocation%	Market Leading Variety #1: BRRI dhan67 (Medium MS, high head rice yield, medium to long growth growth duration)			
Market Slot: Irrigated (Medium slender to long slender grain)			Market Leading Variety #2: BRRI dhan47 (Medium slender, high yield potential)			
Trait Family	Key Economic Traits		Trait Value	Benchmark Variety Assessment	Trait Benchmarking Details	BRRI Breeding Program Assessment
Yield (Paddy)	Yield (>10% higher)		2-Must Have Trait	BRRI dhan67	> BRRI dhan67	Program has trait available
Maturity	Intermediate range-Long	10	2-Must Have Trait	BRRI dhan67	<= BRRI dhan67	Program is actively working with trait
Abiotic Stress Tolerance	Salinity tolerance	25	2-Must Have Trait	BRRI dhan97	> = BRRI dhan97	Program is actively working with trait
Biotic Resistance (Fungal)	Blast	15	2-Must Have Trait	BRRI dhan67	Standard Evaluation Scale =< 3	Program has trait available
Biotic Resistance (Bacterial)	BLB	10	3-Trait Values	BR11607-4R-72 (<i>xa5</i> , <i>xa13</i> , <i>Xa21</i>)	Standard Evaluation Scale =< 3	Program has trait available
Biotic Resistance (Insect)	BPH	10	3-Trait Values	Rathuheenati	<i>bph17</i> , <i>bph32</i>	Program has trait available
Consumer Traits	Amylose content	15	2-Must Have Trait	BRRI dhan28	=> 25%	Program is actively working with trait
Value added	Zn content	5	3-Trait Values	BRRI dhan74	=> 25 mg/kg	Program is actively working with trait
Yield (Economic)-Head Rice	Head rice recovery	10	2--Must Have Trait	BRRI dhan28	> 50%	Program is actively working with trait
Total		100				

LEGEND: 2= must have traits, 3= value added or game changer

Salinity (T. Aman) Breeding Product Profiles (20% Breeding Program Focus)

Country or Region: Salt affected coastal region and/Whole Bangladesh		Resource allocation %	Market Leading Variety #1: BR23 (Medium MB, high head rice yield, medium to long growth duration)			
Market Slot: T. Aman (Medium bold to medium slender grain)			Market Leading Variety #2: BR10/BRRRI dhan30 (Medium Bold, high yield potential)			
Trait Family	Key Economic Traits		Trait Value	Benchmark Variety Assessment	Trait Benchmarking Details	BRRRI Breeding Program Assessment
Yield (Paddy)	Yield (>10% higher)		2-Must Have Trait	BR23/BR10, BRRRI dhan30	>BR23, 10/ BRRRI dhan30	Program has trait available
Maturity	Long (Photosensitive)	10	2-Must Have Trait	BR23	<= BR23	Program is actively working with trait
Abiotic Stress Tolerance	Salinity tolerance	25	2-Must Have Trait	BRRRI dhan73	> = BRRRI dhan73	Program is actively working with trait
Biotic Resistance (Fungal)	Blast	15	2-Must Have Trait	BRRRI dhan67	Standard Evaluation Scale =< 3	Program has trait available
Biotic Resistance (Bacterial)	BLB	10	3-Trait Values	BR11607-4R-72 (xa5, xa13, Xa21)	Standard Evaluation Scale =< 3	Program has trait available
Biotic Resistance (Insect)	BPH	10	3-Trait Values	Rathuheenati	bph17, bph32	Program has trait available
Consumer Traits	Amylose content	15	2-Must Have Trait	BRRRI dhan28	=> 24%	Program is actively working with trait
Value added	Zn content	5	3-Trait Values	BRRRI dhan72	=> 24 mg/kg	Program is actively working with trait
Yield (Economic)-Head Rice	Head rice recovery	10	2--Must Have Trait	BRRRI dhan28	> 50%	Program is actively working with trait
Total		100				

LEGEND: 2= must have traits, 3= value added or game changer

Product Profile of RLR

BRR I Breeding Product Profiles (15% Breeding Program Focus)						
Country or Region: Whole Bangladesh				Market Leading Variety #1: BRR I dhan49 (Medium slender, high market price, medium growth duration, high tillering)		
Market Slot: Rainfed Lowland Rice (Medium slender)				Market Leading Variety #2: BR11 (Bold, high head rice yield, long growth duration)		
Trait Family	Key Economic Traits	Program Selection Emphasis (%)	Trait Value	Bench Mark Variety Assessment	Trait Benchmarking Details	BRR I Breeding Program Assessment
Yield (Paddy)	Yield (>10% higher)		2- Must have Trait	BRR I dhan49	> BRR I dhan49	Trait Limited or NOT available
Maturity	Intermediate range (110-135 days)	10	2- Must have Trait	BRR I dhan49	<= BRR I dhan49	Program is actively working with trait
Plant Characteristics	Plant height (90-125 cm)	5	1-Nice to Have	BRR I dhan49	<=> BRR I dhan49	Program is actively working with trait
Plant Characteristics	Tillering ability (=>8/hill)	5	2- Must have Trait	BRR I dhan49	>= BRR I dhan49	Program is actively working with trait
Plant Characteristics	Spikelets per panicle (180-250)	5	3- Game Changer	BRR I dhan49	>= BRR I dhan49	Program has trait available
Abiotic Stress Tolerance	Salinity tolerance	5	3- Game Changer	BRR I dhan73	=> BRR I dhan73	Program has trait available
Abiotic Stress Tolerance	Drought tolerance	5	3- Game Changer	BRR I dhan71	=> BRR I dhan71	Program is actively working with trait
Abiotic Stress Tolerance	Submergence tolerance	5	1-Nice to Have	BRR I dhan52	=> BRR I dhan52	Program is actively working with trait

Continued

BRR I Breeding Product Profiles (15% Breeding Program Focus)						
Country or Region: Whole Bangladesh			Market Leading Variety #1: BRR I dhan49 (Medium slender, high market price, medium growth duration, high tillering)			
Market Slot: Rainfed Lowland Rice (Medium slender)			Market Leading Variety #2: BR11 (Bold, high head rice yield, long growth duration)			
Trait Family	Key Economic Traits	Program Selection Emphasis (%)	Trait Value	Bench Mark Variety Assessment	Trait Benchmarking Details	BRR I Breeding Program Assessment
Abiotic Stress Tolerance	Heat tolerance	5	3- Game Changer	BRR I dhan98	= N22	Trait Limited or NOT available
Biotic Resistance (Fungal)	Sheath blight	5	3- Game Changer	BRR I dhan49	Standard Evaluation Scale =< 3	Trait Limited or NOT available
Biotic Resistance (Fungal)	False smut	5	3- Game Changer	BRR I dhan49	Standard Evaluation Scale =< 3	Trait Limited or NOT available
Biotic Resistance (Bacterial)	BLB	5	3- Game Changer	BRR I dhan49	Standard Evaluation Scale =< 3	Program has trait available
Biotic Resistance (Insect)	RTV	5	3- Game Changer	BRR I dhan49	Standard Evaluation Scale =< 3 (UtriMerah)	Trait Limited or NOT available
Biotic Resistance (Insect)	BPH	5	3- Game Changer	BRR I dhan49	=Rathuheenati	Trait Limited or NOT available
Biotic Resistance (Insect)	GM	5	3- Game Changer	BRR I dhan33	=BRR I dhan33	Program has trait available
Consumer Traits	Amylose content	5	2- Must have Trait	BRR I dhan49	>= 24%	Program is actively working with trait
Yield (Economic)-Head Rice	Head rice recovery	5	2- Must have Trait	BRR I dhan49	=>50%	Program is actively working with trait
Quality (Aroma)	Aroma and flavour	5	3- Game Changer	BRR I dhan70	=> BRR I dhan70	Program is actively working with trait
Nutrition	Zinc	5	1-Nice to Have	BRR I dhan72	>= BRR I dhan72	Program has trait available
Plant Characteristics	Lodging tolerance	5	2- Must have Trait	BRR I dhan49	<= BRR I dhan49 (<10%)	Program is actively working with trait

Short RLR product profile

Target environment: Rainfed Lowland Rice (RLR) ecosystem of Bangladesh			Benchmark variety: BRRI dhan49/ BRRI dhan87
Season: T. Aman (Wet season)			
Traits	Trait specification	Existing traits	Expected traits
Basic	Yield (ton/ha)	6.5	≥ 7.0
	Grain size and shape	MB	MB to LS
	Amylose (%)	25.0	≥ 24.0
	Head rice yield (%)	69.0	≥ 50.0
	Milled Rice Length (mm)	5.8	≥ 5.8
	L-B ratio	2.9	≥ 2.9
	Chalkiness	Tr/Wb9	Tr
	Growth duration (days)	135	110-135
	Lodging tolerance		
Value added	Zinc enriched	None	≥ 20 ppm Zn
Future value added	Disease resistance	None	BB and BPH resistant Blast resistant Sheath blight res.

Product Profile of Blast Resistant Rice (Short duration)

Country or Region: Whole Bangladesh		Selection Emphasis (%)	Market Leading Variety #1: BRRI dhan88		
Market Slot: Irrigated Rice (Medium slender grain)			Market Leading Variety #2: BRRI dhan28		
Traits	Key Traits		Trait Value	Bench Mark	Traits
Yield (Paddy)	Yield (10% higher)	20	2	BRRI dhan88	=> BRRI dhan88
Maturity	Short duration	10	2	BRRI dhan88	135-140 days
Biotic Stress	Blast resistance	20	2	IRRI154-Pi9	SES =< 3 (<i>Pi9, Pi2</i>)
Biotic Resistance	BLB	10	3	BRRI dhan88	SES =< 3 (<i>xa13, Xa21</i>)
Biotic Resistance	BPH	10	3	Rathuheenati	SES =< 3 (<i>Bph32, Bph17</i>)
Consumer Traits	Amylose	10	2	BRRI dhan88	BRRI dhan88 (>= 25 %)
Yield -Head Rice	HR recovery	10	2	BRRI dhan88	= BRRI dhan28 (>=50%)

1= nice to have, 2= must have traits, 3= value added or game changer

Product Profile of Blast Resistant Rice (Long duration)

Country or Region: High temperature areas of Bangladesh		Selection Emphasis (%)	Market Leading Variety #1: BRRI dhan89		
Market Slot: Irrigated Rice (Medium slender grain)			Market Leading Variety #2: BRRI dhan29		
Traits	Key Traits		Trait Value	Bench Mark	Traits
Yield (Paddy)	Yield (10% higher)	20	2	BRRI dhan89	=> BRRI dhan89
Maturity	Long duration	10	2	BRRI dhan89	>150 days
Biotic Stress	Blast resistance	20	2	IRRI154-Pi9	SES =< 3 (<i>Pi9, Pi2</i>)
Biotic Resistance	BLB	10	3	BRRI dhan89	SES =< 3 (<i>xa13, Xa21</i>)
Biotic Resistance	BPH	10	3	Rathuheenati	SES =< 3 (<i>Bph32, Bph17</i>)
Consumer Traits	Amylose	10	2	BRRI dhan89	BRRI dhan89 (>= 25 %)
Yield -Head Rice	HR recovery	10	2	BRRI dhan89	= BRRI dhan28 (>=50%)

1= nice to have, 2= must have traits, 3= value added or game changer

Product Profile of Heat tolerant Rice- Boro

Country or Region: High temperature areas of Bangladesh		Selection Emphasis (%)	Market Leading Variety #1: BRRi dhan89		
Market Slot: Partially Irrigated Rice (Medium slender grain)			Market Leading Variety #2: BRRi dhan29		
Traits	Key Traits		Trait Value	Bench Mark	Traits
Yield (Paddy)	Yield (10% higher)	20	2	BRRi dhan89	=> BRRi dhan89
Maturity	Long duration	10	2	BRRi dhan89	>130 days
Abiotic Stress	Heat tolerance	10	2	N22	SES =< 3
Biotic Resistance	Sheath blight	10	3	BRRi dhan89	SES =< 3
Biotic Resistance	BLB	10	3	BRRi dhan89	SES =< 3 (<i>xa13, Xa21</i>)
Biotic Resistance	BPH	10	3	Rathuheenati	SES =< 3 (<i>Bph32, Bph17</i>)
Biotic Resistance	RTV	10	3	Utrimerah	SES =< 3
Consumer Traits	Amylose	10	2	BRRi dhan89	BRRi dhan89 (>= 25 %)
Yield -Head Rice	HR recovery	10	2	BRRi dhan89	= BRRi dhan28 (>=50%)

1= nice to have, 2= must have traits, 3= value added or game changer

Product Profile of Heat Tolerant Rice (Short duration)

Country or Region: High temperature areas of Bangladesh		Selection Emphasis (%)	Market Leading Variety #1: BRRi dhan98		
Market Slot: Medium slender grain			Market Leading Variety #2: BRRi dhan28		
Traits	Key Traits		Trait Value	Bench Mark	Traits
Yield (Paddy)	Yield (10% higher)	20	2	BRRi dhan98	=> BRRi dhan98
Maturity	Short duration	10	2	BRRi dhan98	100-115 days
Abiotic Stress	Heat tolerance	20	2	N22	SES =< 3
Biotic Resistance	BLB	10	3	BRRi dhan98	SES =< 3 (<i>xa13, Xa21</i>)
Biotic Resistance	BPH	10	3	Rathuheenati	SES =< 3 (<i>Bph32, Bph17</i>)
Biotic Resistance	RTV	10	3	Utrimerah	SES =< 3 (<i>TSV1</i>)
Consumer Traits	Amylose	10	2	BRRi dhan98	BRRi dhan98 (>= 25 %)
Yield -Head Rice	HR recovery	10	2	BRRi dhan98	= BRRi dhan28 (>=50%)

1= nice to have, 2= must have traits, 3= value added or game changer

Product Profile of Heat Tolerant Rice (long duration)

Country or Region: High temperature areas of Bangladesh		Selection Emphasis (%)	Market Leading Variety #1: BRR I dhan89		
Market Slot: Medium slender grain			Market Leading Variety #2: BRR I dhan29		
Traits	Key Traits		Trait Value	Bench Mark	Traits
Yield (Paddy)	Yield (10% higher)	20	2	BRR I dhan89	=> BRR I dhan89
Maturity	Long duration	10	2	BRR I dhan89	>130 days
Abiotic Stress	Heat tolerance	20	2	N22	SES =< 3
Biotic Resistance	BLB	10	3	BRR I dhan89	SES =< 3 (<i>Xa13, Xa21</i>)
Biotic Resistance	BPH	10	3	Rathuheenati	SES =< 3 (<i>Bph32, Bph17</i>)
Biotic Resistance	RTV	10	3	Utrimerah	SES =< 3 (<i>TSV1</i>)
Consumer Traits	Amylose	10	2	BRR I dhan89	BRR I dhan89 (>= 25 %)
Yield -Head Rice	HR recovery	10	2	BRR I dhan89	= BRR I dhan28 (>=50%)

1= nice to have, 2= must have traits, 3= value added or game changer

Product Profile of Heat Tolerant Rice (Partially Irrigated Rice)

Country or Region: Whole Bangladesh		Selection Emphasis (%)	Market Leading Variety #1: BRRI dhan98		
Market Slot: Partially Irrigated Rice (Medium slender grain)			Market Leading Variety #2: BRRI dhan48		
Traits	Key Traits		Trait Value	Bench Mark	Traits
Yield (Paddy)	Yield (10% higher)	20	2	BRRI dhan98	=> BRRI dhan98
Maturity	Short duration	10	2	BRRI dhan98	95-115 days
Abiotic Stress	Heat tolerance	20	3	N22	SES =< 3
Biotic Resistance	BLB	10	3	BRRI dhan98	SES =< 3 (<i>xa13, Xa21</i>)
Biotic Resistance	BPH	10	3	Rathuheenati	SES =< 3 (<i>Bph32, Bph17</i>)
Biotic Resistance	RTV	10	3	Utrimerah	SES =< 3 (<i>TSV1</i>)
Consumer Traits	Amylose	10	2	BRRI dhan98	BRRI dhan98 (>= 25 %)
Yield -Head Rice	HR recovery	10	2	BRRI dhan98	= BRRI dhan98 (>=50%)

1= nice to have, 2= must have traits, 3= value added or game changer

Product Profile of Tidal Submergence tolerant variety

BRR I Breeding Product Profiles (15% Breeding Program Focus)						
Country or Region: Barishal Region				Market Leading Variety #1: Sadamota (Medium bold, tidal submergence tolerance, taller seedling height-80 cm, strong photosensitivity)		
Market Slot: Tidal saline and non-saline environment				Market Leading Variety #2: BRR I dhan76 (Medium bold, moderate tidal submergence tolerance, taller seedling height- 65 cm, moderate photosensitivity)		
Trait Family	Key Economic Traits	Program Selection Emphasis (%)	Trait Value	Bench Mark Variety Assessment	Trait Benchmarking Details	BRR I Breeding Program Assessment
Yield (Paddy)	Yield (>10% higher)		2- Must have Trait	BRR I dhan76	> BRR I dhan76	Program is actively working with trait
Maturity	Late (>150 days)	5	2- Must have Trait	Sadamota	>= Sadamota	Program is actively working with trait
Plant Characteristics	Plant height (Intermediate 125-130 cm)	5	1-Nice to Have	BRR I dhan76	<= BRR I dhan76	Program is actively working with trait
Plant Characteristics	Tillering ability (anaerobic tillering)	5	3- Game Changer	Kumragoir	>= Kumragoir	Program has trait available
Plant Characteristics	Seedling height (>=70 cm)	10	2- Must have Trait	Sadamota	>= Sadamota	Program is actively working with trait
Plant Characteristics	Strong photosensitivity	10	2- Must have Trait	Sadamota	>= Sadamota	Program is actively working with trait
Abiotic Stress Tolerance	Submergence tolerance	10	3- Game Changer	BRR I dhan52	=> BRR I dhan52	Program is actively working with trait
Abiotic Stress Tolerance	Tidal submergence tolerance (higher biomass)	10	2- Must have Trait	Sadamota	=> Sadamota	Program is actively working with trait
Abiotic Stress Tolerance	Siltation tolerance (waxy leaf)	5	3- Game Changer	Sadamota	=> Kalojara	Program has trait available

Continued (TS TPP)

BRRRI Breeding Product Profiles (15% Breeding Program Focus)

Country or Region: Barishal Region			Market Leading Variety #1: Sadamota (Medium bold, tidal submergence tolerance, taller seedling height-80 cm, strong photosensitivity)
Market Slot: Tidal saline and non-saline environment			Market Leading Variety #2: BRRRI dhan76 (Medium bold, moderate tidal submergence tolerance, taller seedling height- 65 cm, moderate photosensitivity)

Trait Family	Key Economic Traits	Program Selection Emphasis (%)	Trait Value	Bench Mark Variety Assessment	Trait Benchmarking Details	BRRRI Breeding Program Assessment
Biotic Resistance (Fungal)	Blast	5	3- Game Changer	BRRRI dhan76	Standard Evaluation Scale =< 3	Program is actively working with trait
Biotic Resistance (Bacterial)	BLB	5	3- Game Changer	BRRRI dhan76	Standard Evaluation Scale (SES)=< 3 (<i>xa13, Xa21</i>)	Program has trait available
Biotic Resistance (Insect)	SB	5	3- Game Changer	BRRRI dhan76	Standard Evaluation Scale =< 3	Trait Limited or NOT available
Biotic Resistance (Insect)	Leaf roller	5	3- Game Changer	BRRRI dhan76	Standard Evaluation Scale =< 1	Trait Limited or NOT available
Consumer Traits	Amylose content	5	2- Must have Trait	BRRRI dhan76	>= 24%	Program is actively working with trait
Yield (Economic)-Head Rice	Head rice recovery	5	2- Must have Trait	BRRRI dhan49	=>50%	Program is actively working with trait
Quality (Grain size and Shape)	Medium Bold	5	3- Game Changer	BRRRI dhan76	=> Sadamota	Program is actively working with trait
Plant Characteristics	Lodging tolerance	5	3- Game Changer	BRRRI dhan49	<= BRRRI dhan49 (<10%)	Trait Limited or NOT available

Priority Research Issues

- Increasing yield potential of stress tolerant (salinity, drought, submergence, stagnant flooding) varieties
- Development of short duration cold tolerant Boro varieties;
- Heat tolerant short duration T. Aman and T. Aus rice
- Development of multiple stress tolerant varieties (biotic and abiotic)
- Development of aerobic and low water requiring crops
- Development of high yielding varieties with nutritional and nutraceutical properties
- Strengthening research and development activities for climate resilience innovations



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Ethiopia Sorghum

Provided by: Ethiopian Institute of Agricultural Research
(EIAR)



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Product Profile for the major sorghum growing environments



Target environment	Product type	Market size	Priority trait	Product Profile
Drylands	Local landraces with Striga resistance and drought tolerant for dry lowlands.	Covers 73%	Drought Striga The major	PP2
	Development of drought-tolerant, and striga-resistant Sorghum varieties with acceptable yield, and grain quality for Ethiopia's dry lowland sorghum growing areas			
	High yielding and drought tolerant & striga resistant hybrids Sorghum with acceptable grain quality for the dry lowland sorghum growing areas of Ethiopia			PP3
Intermediate and Humid lowland	Medium and long-duration sorghum varieties with acceptable grain yield, striga, and anthracnose resistance for intermediate & humid lowland sorghum growing areas.	Covers 17%	Anthracnose, grain mold and Striga,	PP4
	Intermediate maturing OPVs with acceptable grain yield, grain mould and anthracnose resistance for intermediate agro-ecologies with high rainfall			
Highland	Long duration OPVs with acceptable grain yield and stover quality for highland sorghum growing areas. Target agro-ecology	Covers 10%		PP5



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Ethiopia Wheat

Provided by: Ethiopian Institute of Agricultural Research
(EIAR)



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Strategy / product concepts for wheat breeding in Ethiopia

PC	Production Zone	Elevation (m)	Rainfall (mm)	Constraints
PC1	High altitude	2400-2800	> 1000	YR, FHB, SP, weeds, low soil fertility and acidity, water logging,
PC2	Low altitude	< 2000	< 600	Drought/heat stress, SR,
PC3	Irrigated	<1500	<500	Heat, SR, salinity and alkalinity
PC4	Medium altitude	2000-2300	600-850	YR, SR, FHB, weeds, terminal stress, water logging

Table 2: classification of agro-ecologies based on altitude, rainfall and constraints



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Senegal Millet

Provided by:

Institut Sénégalais de Recherches Agricoles
Regional Center of Excellence for Drought
Adaptation (ISRA-CERAAS)



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Pearl Millet

• Target Product N-01

Product concept	Target agro-ecologies	Must have traits	Product development goals
TPP-01: High yielding, early maturing pearl millet OPVs for adaptation to Sahelian zone of Senegal	Central and northern part of the peanut basin agro-ecological zone (300–600 mm/yr)	<ul style="list-style-type: none">➤ Grain Yield of > 2 tons/ha➤ Downy mildew resistance➤ Head length > 50 cm	10% increase in grain yield over improved local check (Souna 3) with >40 ppm Fe

• Target Product N-02

Product concept	Target agro-ecologies	Must have traits	Product development goals
<p>TPP-02: High yielding, Medium maturity, pearl millet OPV Sudanian zone of Senegal</p>	<p>Target : Target: Southern part of the peanut basin agro-ecological zone (500–900 mm/yr)</p>	<ul style="list-style-type: none"> ➤ Grain Yield of > 2 tons/ha ➤ Downy mildew resistance ➤ Head length > 50 cm 	<p>10% increase in grain yield over improved local check (Thialack II) with > 40 ppm Fe</p>

• Target Product N-03

Product concept	Target agro-ecologies	Must have traits	Product development goals
<p>TPP-03: Early maturity, high yielding hybrids for adaptation to better endowed environments of West Africa</p>	<p>Target : Central and northern part of the peanut basin agro-ecological zone (300–600 mm/yr)</p>	<ul style="list-style-type: none"> ➤ Grain Yield of > 3 tons/ha ➤ Downy mildew resistance ➤ Head length > 35 cm 	<p>15% increase in grain yield over improved local check (TAAW) with > 40 ppm Fe</p>

• Target Product N-04

Product concept	Target agro-ecologies	Must have traits	Product development goals
<p>TPP-04: High yielding, late maturing pearl millet OPVs for adaptation to Guinean zone of Senegal</p>	<p>Target : southern part of the country (Casamance, Eastern Senegal; >900 mm/yr)</p>	<ul style="list-style-type: none"> ➤ Grain Yield of > 2 tons/ha ➤ Downy mildew resistance ➤ Head length > 40 cm 	<p>10% increase in grain yield over improved local check (Sanio de Sefa) with > 40 ppm Fe</p>



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Senegal Rice

Provided by:
Institut Sénégalais de Recherches Agricoles
Regional Center of Excellence for Drought
Adaptation (ISRA-CERAAS)



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Rainfed Lowland Rice Breeding Product Concepts

Product concept	Target and spillover agro-ecologies	Must have traits	Product development goals
High yielding, early maturing rice varieties for adaptation to rainfed lowland ecologies of Senegal	Central and south peanut basin agro-ecological zone (700-800 mm/yr)	<ul style="list-style-type: none"> • Grain Yield of > 7 tons/ha • Tolerance to salinity (= Rok 5, WAR 77) • Average Plant height > 110 cm • Seedling stage drought tolerance 	<p>High yielding, early maturing, tolerance to lowland soil toxicity (Fe toxicity, acidity and salinity), Long slender and soft texture grain type</p> <p>10% increase in grain yield over improved check (ISRIZ10)</p>
High yielding, medium maturing inbred rice varieties for adaptation to rainfed lowland ecologies of Senegal	Lower and Middle Casamance region Upper Casamance and Eastern Senegal regions (900-1000 mm/yr)	<ul style="list-style-type: none"> • Grain Yield of > 7 tons/ha • Tolerance to iron toxicity (= DJ 684-D) • Tolerance to salinity (WAR 77) • Av Plant height > 120 cm • Lodging tolerance 	<p>High yielding, tolerance to lowland soil toxicity (Fe toxicity, acidity and salinity), medium duration, long slender and soft texture grain type</p> <p>10% increase in grain yield over improved check (BG 90-2)</p>



Rainfed Lowland Rice

Product concept	Target and spillover agro-ecologies	Must have traits	Product development goals
<p>TPP-01: High yielding, early maturing rice varieties for adaptation to rainfed lowland ecologies of Senegal</p>	<p>Central and southern part of the peanut basin agro-ecological zone (700-800 mm/yr)</p>	<ul style="list-style-type: none"> • Grain Yield of > 7 tons/ha • Tolerance to salinity (= Rok 5, WAR 77) • Average Plant height > 110 cm • Seedling stage drought tolerance 	<p>High yielding, early maturing, tolerance to lowland soil toxicity (Fe toxicity, acidity and salinity), Long slender and soft texture grain type</p> <p>10% increase in grain yield over improved check (ISRIZ10)</p>
<p>TPP-02: High yielding, medium maturing inbred rice varieties for adaptation to rainfed lowland ecologies of Senegal</p>	<p>Lower and Middle Casamance regions Upper Casamance and Eastern Senegal regions (900-1000 mm/yr)</p>	<ul style="list-style-type: none"> • Grain Yield of > 7 tons/ha • Tolerance to iron toxicity (= DJ 684-D) • Tolerance to salinity (WAR 77) • Av Plant height > 120 cm • Lodging tolerance 	<p>High yielding, tolerance to lowland soil toxicity (Fe toxicity, acidity and salinity), medium duration, long slender and soft texture grain type</p> <p>10% increase in grain yield over improved check (BG 90-2)</p>

Rainfed Upland Rice Breeding Product Concepts

Product concept	Target and spillover agro-ecologies	Must have traits	Product development goals
High yielding, early maturing inbred rice varieties for adaptation to rainfed upland ecologies of Senegal	Central and southern part of the peanut basin (700-800 mm/year)	Grain Yield of > 5 tons/ha, Drought tolerance Average Plant height 100 cm Early maturing (70- 80 days) Termite resistance Seedling stage drought tolerance	High grain yield, drought tolerance, Early maturing, long slender and soft texture grain type: 10% increase in grain yield over improved check (NERICA 8)
High yielding, medium maturing inbred rice varieties for adaptation to rainfed upland ecologies of Senegal	Southern part of the peanut basin Lower and Middle Casamance region Upper Casamance and Eastern Senegal regions (900-1200 mm/year)	Grain Yield of > 5 tons/ha, Drought tolerance (= DJ 11-509) Average Plant height 100 cm Termite resistance Seedling stage drought tolerance	High yielding, Drought tolerance, Medium duration, Long slender and Soft texture grain type: 10% increase in grain yield over improved check (NERICA 5)



Rainfed Upland Rice

Product concept	Target and spillover agro-ecologies	Must have traits	Product development goals
<p>TPP-01: High yielding, early maturing inbred rice varieties for adaptation to rainfed upland ecologies of Senegal</p>	<p>Central and southern part of the peanut basin agro-ecological zone (700-800 mm/year)</p>	<p>Grain Yield of > 5 tons/ha, Drought tolerance Average Plant height 100 cm Early maturing (70- 80 days) Termite resistance Seedling stage drought tolerance</p>	<p>High grain yield, drought tolerance, Early maturing, long slender and soft texture grain type:</p> <p>10% increase in grain yield over improved check (NERICA 8)</p>
<p>TPP-02: High yielding, medium maturing inbred rice varieties for adaptation to rainfed upland ecologies of Senegal</p>	<p>Southern part of the peanut basin Lower and Middle Casamance regions Upper Casamance and Eastern Senegal regions (900-1200 mm/year)</p>	<p>Grain Yield of > 5 tons/ha, Drought tolerance (= DJ 11-509) Average Plant height 100 cm Termite resistance Seedling stage drought tolerance</p>	<p>High yielding, Drought tolerance, Medium duration, Long slender and Soft texture grain type:</p> <p>10% increase in grain yield over improved check (NERICA 5)</p>



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The U.S. Government's Global Hunger & Food Security Initiative

Senegal Sorghum

Provided by:
Institut Sénégalais de Recherches
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Sorghum

• Target Product N-01

Product concept	Target and spillover agro-ecologies	Must have traits	Product development goals
<p>TTP-01: Early maturing (80-95 das) dual-purpose (grain and forage) tannin-free non-photosensitive and High yielding sorghum varieties with resistance to striga, drought and diseases (<i>grain mold and long smut</i>)</p>	<p>Soudano-sahelian zone Central north of groundnut Basin 300 – 600 mm</p> <p>Spillover: Gambia, Mali, Niger, Mauritania, Burkina Faso, Togo, Ivory Coast</p>	<ul style="list-style-type: none"> • Seedling vigor (\geq Payenne or Grinkan, • Stable high grain yield (\geq Payenne) • High Fodder yield (\geq Grinkan) • Semi-compact or semi-loose panicles with good exertion (=Payenne) • Grain quality (\geq Payenne) • Resistance to drought (\geq Tx7000 and B35) • Resistance to disease (grain mold, smut) (\geq CE180-33 or Sureño) • Resistance to Striga (\geq SRN39, NI3) 	<ul style="list-style-type: none"> • 20 to 60% in yield increase over farmers OPVs (<i>Bassi, Fella, Bassi Mbodjene, Teigne</i>) • 10 to 30% yield increase over improved variety Payenne and Golobé under stress • 15 to 40% increase in fodder yield /m² (<i>Fella, Bassi, Teigne, Bassi Mbodjene,</i>)

• Target Product N-02

Product concept	Target and spillover agro-ecologies	Must have traits	Product development goals
<p>TTP-02: Medium duration (95-110 das) dual-purpose sorghum varieties with resistance to striga, drought and diseases (grain mold and long smut)</p>	<p>Soudanian zone Central south of groundnut Basin 600 – 800 mm</p> <p>Spillover: Gambia, Mali, Mauritania, Niger, Burkina Faso, Togo, Ivory Coast</p>	<ul style="list-style-type: none"> • Seedling vigor (\geq Faourou or Grinkan, • Stable high grain yield (\geq Faourou) • High Fodder yield (\geq Grinkan) • Semi-compact or semi-loose panicles with good exertion (=Payenne) • Grain quality (\geq Darou, Faourou) • Resistance to drought (\geq Tx7000 and B35) • Resistance to disease (grain mold, smut) (\geq CE180-33 or Sureño) • Resistance to Striga (\geq SRN39, NI3) 	<ul style="list-style-type: none"> • 20 to 60% in yield increase over farmers OPVs (<i>Bassi, Kinto, Congossane, Mbayery-danery</i>), • 10 to 30% yield increase over improved varieties Darou and Faourou, • 15 to 40% increase in fodder yield over OPVs (<i>Bassi, Kinto, Congossane, Teigne</i>)

Summary of ISRA-Sorghum Market Segments

Market segment	Zone	Elite variety	KASP Markers
TPP_01: Short duration dual purpose OPV sorghum for food and feed	Zone 300 – 600 mm (80-95 days)	Payenne, Golobé	<i>Stg1-5, Tan1-2, SP1, HI, Lgs1, Ma1-6</i>
TPP_02: Medium duration dual purpose OPV sorghum for food and feed	Zone 600 – 800 mm (95-110 days)	Faourou, Darou	<i>Stg1-5 ; Lgs1; Ma1-6, SP1</i>
TPP_03: Late duration dual purpose OPV sorghum for food and feed	Zone 800 – 1200 mm (110-120 days)	Nganda, Nguinthe	<i>Lgs1 ; Ma1-6, Tan1-2, SP1</i>
TPP_04: <i>Early duration dual purpose OPV sorghum for food and feed for the flood water recession zone</i>	Senegal River Valley (75-90 days)	Payenne, Golobé	<i>Stg1-5, Tan1-2, SP1</i>
TPP_05: Early to medium duration dual purpose sorghum varieties for industrials	Zone 400 – 800 mm (Industrial processing) (80-105 days)	Payenne, Golobé Faourou, Darou Nganda, Nguinthe	<i>HI, bmr6, bmr12, Tan1-2, beta-carotein</i>

Sorghum Breeding Product profile:

Market segment 01	Zone	Must have traits	Product Develop. Goals
Short duration dual purpose sorghum varieties for food and feed	<p>Soudano-sahelian zone</p> <p>Rainfall 300 – 600 mm</p> <p>Maturity (80-95 days)</p> <p>Spillover: Gambia, Mali, Mauritania, Niger, Burkina Faso, Togo</p>	<ul style="list-style-type: none"> • Early maturing (\leq Payenne) • Seedling vigor (\geq Grinkan) • Grain yield (\geq Payenne) • Fodder yield (\geq Grinkan) • Semi-compact or semi-loose panicles (=Golobé) • Good exertion (\geq Payenne) • Tannin free (\geq Payenne) ♣ Resistance to drought (\geq B35) ♣ Resistance to midge (\geq CCAL 1/13-1-1-1) ♣ Resistance to stem borer (??) ♣ Resistance to grain mold (\geq CE180-33) ♣ Resistance to Striga (\geq SRN39) 	<ul style="list-style-type: none"> ✓ 20 to 60% in yield increase over local OPVs (<i>Bassi, Fella, Bassi Mbodjene, Congossane, Teigne</i>) ✓ 10 to 30% yield increase over the improved variety Payenne or Golobé under stress ✓ 15 to 40% increase in fodder yield over local OPVs (<i>Fella, Bassi, Teigne, Congossane</i>) <p style="text-align: center;">Variety to replace <i>Golobé and Payenne</i></p>

Sorghum Breeding Product profile

Market segment 02	Zone	Must have traits	Product Develop. Goals
<p>Medium duration dual purpose sorghum varieties for food and feed</p>	<p>Soudanian zone</p> <p>Rainfall Zone 600 – 800 mm</p> <p>Maturity (95-110 days)</p> <p>Spillover: Gambia, Mali, Mauritania, Niger, Burkina Faso, Togo</p>	<ul style="list-style-type: none"> ♣ <i>Medium duration (\leqFaourou)</i> ♣ <i>Seedling vigor (\geqGrinkan)</i> ♣ <i>Grain yield (\geqFaourou)</i> ♣ <i>Fodder yield (\geqGrinkan)</i> ♣ <i>Semi-compact or semi-loose panicles (=Golobé)</i> ♣ <i>Good exertion (\geqPayenne)</i> ♣ <i>Tannin free (\geqFaourou)</i> ♣ Resistance to drought (\geq B35) ♣ Resistance to disease (grain mold, smut) (\geq CE180-33) ♣ Resistance to Striga (\geq SRN39) 	<ul style="list-style-type: none"> ✓ 20 to 60% in yield increase over OPVs (Bassi, Kinto, Teigne Mbayery-danery), ✓ 10 to 30% yield increase over the improved variety Darou or Faourou, ✓ 15 to 40% increase in fodder yield over OPVs (Bassi, Kinto, Congossane, Teigne) <p style="text-align: right;">Variety to replace Faourou and Darou</p>

Sorghum Breeding Product profile

Market segment 03	Zone	Must have traits	Product Develop. Goals
Late duration dual purpose OPV sorghum for food and feed	<p>Guinea Zone</p> <p>Rainfall 800 – 1200 mm</p> <p>Maturity (110-120 days)</p> <p>Spillover: Gambia, Mali, Mauritania, Niger, Burkina Faso, Togo</p>	<ul style="list-style-type: none"> • <i>Late maturing</i> (\leqNganda) • <i>Seedling vigor</i> (\geqGrinkan) • <i>Stable high grain yield</i> (\geqNganda) • <i>High Fodder yield</i> (\geqGrinkan) • <i>Semi-compact or semi-loose panicles</i> (=Golobé) • <i>Good exertion</i> (\geqPayenne) • <i>Tannin free</i> (\geqNganda) ♣ Moderate photoperiod Sensitivity (\geqGrinkan) ♣ Resistance to drought (\geq B35) ♣ Resistance to <i>Anthracnose</i>, and grain mold (\geq F2-20) ♣ Resistance to Striga (\geq SRN39) 	<ul style="list-style-type: none"> ✓ 50-65% reduction in plant high (Mbayery, Kinto, Nianikel Niodjé), ✓ 20 to 60% in yield increase over OPVs (Mbayery, Kinto, Nianikel Niodjé), ✓ 10 to 30% yield increase over the improved variety (F2-20, Nguinthe, Nganda) <p style="text-align: center;">Variety to replace F2-20, Nguinthe, and Nganda</p>

Sorghum Breeding Product profile

Market segment 04	Zone	Must have traits	Product Develop. Goals
<p><i>Early duration dual purpose sorghum varieties for food and feed for the flood water recession zone</i></p>	<p>Senegal River Valley</p> <p>Zone <i>water flooding recession</i></p> <p>Maturity <i>(75-90 days)</i></p> <p>Spillover: Gambia, Mali, Mauritania, Niger, Burkina Faso, Togo</p>	<ul style="list-style-type: none"> • Early maturing (\leq Payenne) • <i>Seedling vigor</i>, (\geq Grinkan) • <i>Grain yield</i> (\geq Payenne) • <i>Fodder yield</i> (\geq Golobé) • <i>Semi-compact or semi-loose panicles</i> • <i>Good exertion</i> (=Payenne) • <i>Tannin Free</i> (\geq Payenne) ♣ Resistance to cold (\geq Samé) ♣ Resistance to steam borer (??) ♣ Resistance to bird damage (??) ♣ Resistance to long smut (??) 	<ul style="list-style-type: none"> ✓ 20 to 40% reduction in plant high (Purdi, Sévil, Ndiakhnat, Samé), ✓ 20 to 60% in yield increase over OPVs (Purdi, Sévil, Ndiakhnat, Samé), ✓ 10 to 30% yield increase over the improved variety (Payenne, Golobé, CE151-262) ✓ 15 to 40% increase in fodder over OPV (Samé, Purdi, Sévil, Ndiakhnat) <p style="text-align: center;">Variety to replace Samé, Sévil, Purdi, Ndiakhnat</p>

Sorghum Breeding Product profile

Market segment 05	Zone	Must have traits	Product Develop. Goals
<p>Early to medium duration dual purpose sorghum varieties for industrials</p> <p><i>(Industrial processing)</i></p>	<p>Soudano-Sahelian/Soudanian zone</p> <p>Rainfall 400 – 800 mm</p> <p>Maturity (80-105 days)</p> <p>Spillover: Gambia, Mali, Mauritania, Niger, Burkina Faso, Togo</p>	<ul style="list-style-type: none"> • <i>Early to medium maturing (\leqNganda)</i> • <i>Seedling vigor (\geqGrinkan)</i> • <i>Grain yield (\geqNganda)</i> • <i>Fodder yield (\geqGrinkan)</i> • <i>Semi-compact or semi-loose panicles (=Golobé)</i> • <i>Good exertion (\geqPayenne)</i> • <i>Tannin free (\geqNganda)</i> ♣ Grain size (L28) ♣ Protein content (Ni_133, Sn_110) ♣ Provitamin A (??) ♣ Grain protein digestibility (P721Q) ♣ Forage quality (??) ♣ High mineral content (Iron, Zinc, Mg) 	<ul style="list-style-type: none"> ✓ 20 to 60% in yield increase over local OPVs (Bassi, Fella, Bassi Mbodjene, Congossane, Teigne) ✓ 10 to 30% yield increase over the improved variety (Payenne, Golobé, Faourou) ✓ 15 to 40% increase in fodder yield over local OPVs (Fella, Bassi, Teigne, Congossane) <p style="text-align: center;">Variety to replace</p> <p style="text-align: center;"><i>Golobé, Payenne, Faourou</i></p>

Summary BPP

Market segment	Key Traits	Varieties to Replace	Markers
MS_01 : Short duration dual purpose sorghum for food and feed (<i>Rainfall 300 – 600 mm</i>)	<i>Drought, Striga, Midge, Steam borer, Grain mold</i>	Payenne, Golobé, CE151-262	<i>Stg1-5, Lgs1</i>
PCN_02 : Medium duration dual purpose sorghum for food and feed (<i>Rainfall 600 – 800 mm</i>)	<i>Drought, Striga, Midge, Steam borer, Grain mold</i>	Faourou, Darou, CE180-33	<i>Stg1-4 ; Lgs1; Ma1-Ma6</i>
MS_03 : Late duration dual purpose sorghum for food and feed (<i>Rainfall 800 – 1200 mm</i>)	<i>Photoperiod, Drought, Striga, Anthracnose, Grain mold, Long smut,</i>	Nganda, Nguinthe, F2-20	<i>Lgs1 ; Ma1-Ma6</i>
MS_04 : <i>Early duration dual purpose sorghum for food and feed for the flood water recession zone (Senegal River Valley)</i>	<i>Cold, Steam borer, Bird damage, Long smut</i>	Samé, Sevil, Purdi	<i>Stg1-4</i>
MS_05 : Early to medium duration dual purpose sorghum for industrials (<i>Rainfall 400–800 mm</i>)	<i>Grain size, Protein content, Protein digestibility, Provitamin A, Forage digestibility, High mineral content (Iron, Zinc, Mg)</i>	Payenne, Golobé, Faourou, Nganda,	<i>H1; bmr6; bmr12</i>



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Priority Breeding Product Profiles (ISRA)

Bread Wheat

Target Product: Hamat

Product concept	Target and spillover agro-ecologies	Must have traits	Product development goals
<p>TPP-01: Early maturing (85 das) and high yielding wheat varieties with good baking quality and tolerance to heat</p>	<p>Soudano-sahelian zone</p> <p>Senegal River and Anambe Valley (high temperature irrigated)</p> <p>Spillover: Gambia, Mali, Niger, Mauritania, Burkina Faso, Togo, Ghana, Benin, Nigeria</p>	<ul style="list-style-type: none"> • <i>Seedling vigor</i> (\geq Dire 15) • <i>Earliness</i> (\geq Hamat) • <i>high grain yield</i> (\geq Misr I) • <i>High Fodder yield</i> (\geq Alioune) • <i>Good baking quality</i> (\geq Hamat) • Tolerance to heat (\geq Hamat) • Tolerance to disease (grain mold, smut) (\geq Alioune) 	<ul style="list-style-type: none"> • 10 to 20% in yield increase • 15 to 20% increase in fodder • Tolerance to heat and disease over released varieties • Good quality (high milling recovery and baking quality)

Bread Wheat

• Target Product N-01 (Hamat)

Product concept	Target and spillover agro-ecologies	Must have traits	Product development goals
<p>TPP-01: Early maturing (85 das) and high yielding wheat varieties with good grain quality (baking quality) and tolerance to heat</p>	<p>Soudano-sahelian zone Senegal River and Anambe Valley (high temperature irrigated)</p> <p>Spillover: Gambia, Mali, Niger, Mauritania, Burkina Faso, Togo, Ghana, Benin, Nigeria</p>	<ul style="list-style-type: none"> • <i>Seedling vigor</i> (\geq Dire 15) • <i>Earliness</i> (\geq Dire 15 or Hamat) • <i>high grain yield</i> (\geq Misr 1) • <i>High Fodder yield</i> (\geq Alioune) • Tolerance to heat (\geq Dire 15 or Hamat) • Tolerance to disease (grain mold, smut) (\geq Alioune or Dire 15) 	<ul style="list-style-type: none"> • 10 to 20% in yield increase over Introduced varieties • 15 to 20% increase in fodder • Tolerance to heat and disease over improved variety Dire 15 and Alioune • Good grain quality (high milling recovery and baking quality)

Durum Wheat

• Target Product N-01 (Haby)

Product concept	Target and spillover agro-ecologies	Must have traits	Product development goals
<p>TPP-01: Early maturing (90 das) and high yielding wheat varieties with good grain quality (yellow pigment bold grain) and tolerance to heat.</p>	<p>Soudano-sahelian zone</p> <p>Senegal River and Anambe Valley (high temperature irrigated)</p> <p>Spillover:</p> <p>Gambia, Mali, Niger, Mauritania, Burkina Faso, Togo, Ghana, Benin, Nigeria</p>	<ul style="list-style-type: none"> • <i>Earliness</i> (\geq Dioufissa 85 das) • <i>high grain yield</i> (\geq Haby) • <i>high kernel weight</i> (\geq Haby) • <i>High Fodder yield</i> (\geq Amina or Dioufissa) • <i>Tolerance to disease</i> • Tolerance to heat (\geq Dioufissa) • Good grain quality (yellow pigment bold grain, low yellow berry) (\geq Amina or Dioufissa) 	<ul style="list-style-type: none"> • Very early maturing (80 to 85 das) • 15 to 20% increase in fodder yield /m² (<i>Amina or Dioufissa</i>) • Tolerance to heat and disease over improved variety Dioufissa • Good grain quality