



Market Intelligence Digest

Sorghum | Mali

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Market Intelligence
Area of Work

The CGIAR Market Intelligence Area of Work aims to maximize the impact and return on investment of breeding programs by integrating market insights, behavioral intelligence, and strategic prioritization. It identifies high-impact opportunities, guides product development, and enhances product adoption and lifecycle management through decision-support tools.

ENGLISH VERSION

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A. Market Segments

	Harvested area (ha)	% of Total harvested area
Total Area Covered by Seed Product Market Segment (Active only)	1,762,995	100
<u>Sorghum WAF MS00400</u> Sorghum Non-Hybrid WAF Food; Fodder White; Cream Sudan; Guinea zone Rainfed Mid	1,057,797	60
<u>Sorghum WAF MS00673</u> Sorghum Non-Hybrid WAF Food; Fodder White; Cream Sahelian Zone Rainfed Early	528,899	30
<u>Sorghum WAF MS00675</u> Sorghum Hybrid WAF Food; Fodder White; Cream Sudan; Guinea zone Rainfed Mid	88,149	5
<u>Sorghum WAF MS00678</u> Sorghum Non-Hybrid WAF Food; Food Processing; Poultry White Guinea zone; Sudan Rainfed Mid	70,520	4
<u>Sorghum WAF MS00674</u> Sorghum Hybrid WAF Food; Fodder White; Cream Sahelian Zone Rainfed Early	17,630	1
National Harvested Area (ha) (FAOSTAT)	1,762,994	
Difference between market-segmented area and national harvested area	-1	0

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B. Market Segment Criteria

MS Criteria	Value	Harvested area (ha)	% of Total harvested area
Crop	Sorghum	1,762,995	100
Subregion	West Africa	1,762,995	100
Material Type	Non-Hybrid	1,657,216	94
	Hybrid	105,779	6
Consumer Product Type	Fodder; Food	1,692,475	96
	Food; Food Processing; Poultry	70,520	4
Color	Cream; White	1,692,475	96
	White	70,520	4
Production Environment	Guinea zone; Sudan	1,216,466	69
	Sahelian Zone	546,529	31
Production System	Rainfed	1,762,995	100
Maturity	Mid	1,216,466	69
	Early	546,529	31

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C. Target Product Profiles and Breeding Pipelines

Seed Product Market Segment	Target Product Profile	Breeding Pipeline	Breeding Effort
<u>Sorghum WAF MS00400</u>	<u>Sorghum WAF CIMMYT TPP00810</u> <u>Sorghum WAF ICRISAT TPP01036</u>	Sorghum CIMMYT BP00226 Sorghum ICRISAT BP00176	Category 1: Full -
<u>Sorghum WAF MS00673</u>	<u>Sorghum WAF CIMMYT TPP00809</u> <u>Sorghum WAF ICRISAT TPP01037</u>	Sorghum CIMMYT BP00225 Sorghum ICRISAT BP00174	Category 1: Full Category 1: Full
<u>Sorghum WAF MS00674</u>	<u>Sorghum WAF CIMMYT TPP00812</u> <u>Sorghum WAF ICRISAT TPP01039</u>	Sorghum CIMMYT BP00228 Sorghum ICRISAT BP00176	Category 1: Full Category 1: Full
<u>Sorghum WAF MS00675</u>	<u>Sorghum WAF CIMMYT TPP00813</u> <u>Sorghum WAF ICRISAT TPP01040</u>	Sorghum CIMMYT BP00229 Sorghum ICRISAT BP00180	Category 1: Full Category 1: Full
<u>Sorghum WAF MS00678</u>	<u>Sorghum WAF CIMMYT TPP00814</u> <u>Sorghum WAF ICRISAT TPP01041</u>	Sorghum CIMMYT BP00226 Sorghum ICRISAT BP00180	Category 2: Early and Late Testing Category 2: Early and Late Testing

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D. Mapping Traits from TPPs and MI Evidence to Value Propositions

Value Proposition	Essential improved traits from 10 TPPs*	Key traits from MI Evidence
01 Farmer • Higher Productivity	Grain yield (at 12.5% moisture content) (10)	Hybrid Heterosis (Vigor)
02 Farmer • Higher fodder yield or value	Fodder yield (8)	Higher Stover/Fodder Yield
04 Farmer • Less Loss & Risk: Biotic stress	- Anthracnose Resistance (4) - Midge Tolerance (10) - Striga resistance (10)	Striga Resistance
06 Farmer • Less Loss – Other	No essential traits to be improved	Bird Resistance (Lax Panicles/Awns)
07 Farmer • Greater fertilizer use efficiency	No essential traits to be improved	Low-Phosphorus Adaptation
09 Farmer • Appropriate maturity	No essential traits to be improved	- Photoperiod Sensitivity - Short-Duration Maturity (Earliness)
10 Farmer/user • Longer storage life		Grain Hardness (Vitreousness)
11 User • Less labour	No essential traits to be improved	High Threshability (Ease of Decortication)
12 User • Meeting end-user requirements	No essential traits to be improved	- Excellent Food Taste - Grain Uniformity - High Decortication (Food) Yield - Large Grain Size - Starch Consistency (Porridge Firmness) - Starch Viscosity/Stickiness - Tan (Non-Anthocyanin) Plant Type - White Grain Color
13 User • Better nutrition and/or health	No essential traits to be improved	Biofortification (Iron and Zinc Content)
14 Multiplier – Easier to multiply	No essential traits to be improved	Morphological Distinctness

* Values in parentheses () reflect the frequency of appearance of each essential improved trait across the active TPPs.

See **Section E** for reference

Note: "Essential: Maintain" and "Nice-to-Have" traits of TPPs are not included in the table

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D. Mapping Traits from TPPs and MI Evidence to Value Propositions

List of Value Propositions

- **01 Farmer • Higher Productivity:** More yield in a representative target environment.
- **02 Farmer • Higher fodder yield or value:** More fodder: yield and quality (like digestibility)
- **03 Farmer • Less Loss & Risk: CC relevant stress:** Avoided yield losses and more production stability in the face of climate change-relevant shocks and stresses such as drought, excess water (excessive rains, waterlogging, submergence, typhoons), heat, and salinity
- **04 Farmer • Less Loss & Risk: Biotic stress:** More production where and when this pest or disease occurs.
- **05 Farmer • Less Loss @ Location:** Crop production in less favorable environmental conditions, such as cold, acidity, alkalinity, shade, salinity, iron toxicity.
- **06 Farmer • Less Loss – Other:** Less loss in the field due to shattering or lodging.
- **07 Farmer • Greater fertilizer use efficiency:** Less need for fertilizer, more production at low levels of fertilizer, biological nitrification inhibition (BNI).
- **08 Farmer • Less labour:** Ability to mechanize. Less work and drudgery for weeding, harvesting and on-farm sorting.
- **09 Farmer • Appropriate maturity:** Better fit in the cropping system. Varieties that may induce early maturity or prolong the time it takes to harvest the crop.
- **10 Farmer/user • Longer storage life:** Longer storage with fewer losses. Other avoided losses due to processing?
- **11 User • Less labour:** Less labour for home processing (peeling/shelling ability (incl. shape), cooking time).
- **12 User • Meeting end-user requirements:** Product meets market intermediaries/end-use requirements in critical aspects. Physiological improvements that focus on standards/qualities of formal markets (e.g. color, size, texture, protein)
- **13 User • Better nutrition and/or health:** More nutritional and/or healthier product regarding protein, fiber, iron, zinc, beta-carotene and toxins. When combined with awareness raising and nutrition education, results in higher (induced) demand.
- **14 Multiplier – Easier to multiply:** Lower costs to multiplier; greater seed availability to farmers.
- **15 Other:** Undefined value to farmer, end user, or multiplier

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E. Synthesis of evidence highlighting key traits by thematic area

Overview

The dominant sorghum production system in Mali relies on indigenous Guinea-race germplasm, as its unique photoperiod sensitivity is essential for synchronizing flowering with the end of erratic rainy seasons. The weight of evidence indicates that while newly released Guinea-race hybrids provide widespread yield advantages, their adoption is severely hindered by a historical state monopoly on seed supply and the absence of organized marketing associations. These systemic inefficiencies exacerbate a critical trait gap: the failure of many improved varieties to meet the specialized "food yield" and sensory requirements of women processors, who are the primary actors in the traditional value chain. Consequently, a successful product profile must move beyond grain yield alone to integrate industrial processability for emerging urban mills and low-phosphorus adaptation for the marginalized individual plots widely managed by women.

1. Consumers

- **Grain Hardness (Vitreousness):** The vast majority of consumers require hard grains to prevent biological loss to storage insects and ensure grain integrity during manual processing.
- **White Grain Color:** A widespread cultural norm for white flour leads to the absolute market rejection of varieties that produce dark or gray porridge.
- **High Decortication (Food) Yield:** Women processors prioritize the total volume of edible flour and grits remaining after bran removal to ensure household food security.
- **Large Grain Size:** Discerning consumers highly prefer large grains because of their superior suitability for preparing marketable semolina and couscous.
- **Excellent Food Taste:** High end-user acceptance is dominant only for varieties that maintain traditional organoleptic profiles for household consumption.

2. Processors

- **Starch Consistency (Porridge Firmness):** Processors require grains that produce a firm, non-sticky porridge (Tô) that does not adhere to fingers or teeth after cooling.
- **Tan (Non-Anthocyanin) Plant Type:** Breeding for tan plant types is essential to avoid red grain discoloration that necessitates excessive, wasteful decortication labor.
- **Grain Uniformity:** High uniformity in grain shape and size is a widespread technical requirement for maximizing the efficiency of mechanized urban flour mills.
- **Starch Viscosity/Stickiness:** Functional starch properties are widespread requirements for achieving the specific textures needed for diverse artisanal food products.
- **High Threshability (Ease of Decortication):** Varieties that detach easily from the glume significantly reduce the manual pounding labor widely performed by women.

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E. Synthesis of evidence highlighting key traits by thematic area

3. Producers

- **Hybrid Heterosis (Vigor):** Well-adapted Guinea-race hybrids provide dominant yield gains under farmer management compared to local open-pollinated cultivars.
- **Waterlogging and Inundation Tolerance:** Resistance to waterlogged conditions is a widespread priority for survival during extreme downpours and precipitation variability.
- **Striga Resistance:** Resistance to the parasitic weed *Striga hermonthica* is the dominant biotic requirement for stabilizing yields on depleted Malian soils.
- **Photoperiod Sensitivity:** This widespread trait is essential for ensuring that flowering occurs at the end of the rainy season regardless of unpredictable sowing dates.
- **Higher Stover/Fodder Yield:** Producers prioritize tall-statured varieties with high biomass to maintain draft animals and small ruminants during the dry season.

4. Gender & Social Inclusion

- **Low-Phosphorus Adaptation:** Women are widely allocated marginal plots with depleted soil, requiring varieties with high phosphorus use efficiency.
- **Short-Duration Maturity (Earliness):** Women often sow late due to labor prioritization, necessitating early maturity to escape end-of-season drought.
- **Bird Resistance (Lax Panicles/Awns):** Physical deterrents are essential to mitigate the dominant risk of concentrated bird attacks on women's late-maturing fields.
- **Biofortification (Iron and Zinc Content):** Women show a widespread preference for high iron and zinc content to improve maternal and child health outcomes.
- **Morphological Distinctness:** Distinct visual markers are widespread requirements to facilitate variety identification and maintain purity within informal village seed exchange networks.

5. Enabling Environment

- **Access to Production Credit:** Establishing financing through the National Development Bank of Mali is essential for the purchase of inputs for non-cotton cereal systems.
- **Improved Household Storage (PICS Sacks):** Provision of triple-layer sacks is essential for preventing widespread storage losses and mitigating "liquid pressure" at harvest.
- **Harmonized Variety Release (QDS):** Adopting Quality Declared Seed standards is essential for validating decentralized seed production by farmer cooperatives.
- **Rural Feeder Road Construction:** Investment in logistics is essential to reduce high transport costs that isolate smallholders from urban industrial markets.
- **Market Aggregation for Farmer Organizations:** Strengthening the ability of associations to bulk grain is essential for securing contracts with institutional buyers like the World Food Program.

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E. Synthesis of evidence highlighting key traits by thematic area

References

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Annex 1. Insights from Market Intelligence Publications

No data available

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Annex 2: Requests for MI Evidence from PDT Meetings

MI Researchable Questions	Value Chain	Regional Crop Network	CGIAR coordinating Center	Network Priority
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No data available

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Annex 3: Definitions of commonly-used terms

Terms	Description
Market Segment or Seed Product Market Segment (SPMS)	A group of farmers with common product needs, driven by consumer and processor requirements (what) combined with a set of farmer requirements based on where and how the product is grown.
Market Segment Criteria	The eight criteria used to identify and define a market segment. Not all market segments will require all criteria to be identified e.g. maturity is not relevant for perennial crops. Non-applicable terms are captured as NA. To begin with, Market Segments were captured at the subregional level. • Crop: A crop in the CGIAR crop breeding portfolio. What entails a crop (as compared to a germplasm type) follows the convention what FAO defines to be a crop, so interoperability with FAO data sets can be ensured. Germplasm Type are used for subspecies (e.g. Plantain and Banana, Durum and Bread (wheat) or other types of consistent subgroupings of crops between which crosses are rarely made (winter wheat, spring wheat). It is the crop's assessment whether and how they want to use this attribute. • Subregion: Subregion(s) and countries on where the crop is grown (MS subregions derived from the seven regions recognized by CGIAR). • Material Type: Hybrid or non-Hybrid • Consumer Product Type: The processor and consumer requirements for a product, how they choose to process the product. • Color: Color of the grain or flesh of the product required by a market segment. • Production Environment (Agroecological Zone): Geographical areas exhibiting similar climatic conditions that determine their ability to support agriculture, typically defined by their geography, humidity and elevation. • Production System: How the crop is grown • Maturity: Maturity of the crop required where the crop is grown.

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Annex 3: Definitions of commonly-used terms

Terms	Description
Target Product Profiles (TPPs)	Defined to understand what essential (and nice-to-have) traits are required in a new product to meet or exceed the needs of farmers, processors and consumers in one particular crop market segment.
Breeding Effort	The extent of effort put on closely related Target Product Profiles (TPPs) that derive from one Breeding Pipeline = crossing block • Category 1: Full: The TPP which is the main target of the breeding effort (= for which most resources are available) is called Category 1 TPP. The Category 1 TPP Essential Trait requirements define the crossing block, and the extraction of candidates for early stage testing, late stage testing and on-farm verification. A Breeding Pipeline can only have one Category 1 TPP. The other TPPs that derive from the same population improvement effort, are assigned Category 2, 3 or 4. • Category 2: Early and Late Testing: This category has a separate variety selection effort that selects different candidates from early stage testing, before proceeding to late stage testing and on-farm verification. This is typically the case when CGIAR breeding programs send the same set of lines, clones or hybrids for early testing to partners and these partners select (and/or extract in the case of segregating lines) different TPPs out of the materials received.. • Category 3: Backcrossing: This category differs from Category 1 by one or two simply inherited Essential Improve Trait(s) that can be achieved through backcrossing. • Category 4: Late Testing: This category has a separate variety selection effort that selects different candidates from late-stage testing, before proceeding to on-farm verification. • Category 5: None: This category is for Market Segments with no TPP defined or no TPP linked to a CGIAR Breeding Pipeline
Breeding Pipeline	The sum of the breeding efforts (product design, crossing and screening, early-stage testing, late-stage testing and on farm verification) focused on a market segment or on a group of similar market segments with very similar target product profiles ending with the identification of distinct products for each market segment the pipeline is focused on.

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Annex 3: Definitions of commonly-used terms

Terms	Description
Essential Traits	Traits must be at or above the threshold value in all new products for a market segment in order to meet/exceed farmer, processor, and consumer requirements.
Essential Improve Traits	Traits are deliberately being improved in the breeding scheme for a market segment.
Essential Maintain Traits	Traits are being maintained at their current level in the breeding scheme for a market segment.
Nice-to-Have Traits	Traits do not need to be in all new products for a market segment to meet/exceed farmer, processor, and consumer requirements.

Value Proposition

Value Proposition is both a strategic and a marketing concept. Value propositions identify the benefits that products (or services) will deliver to users. In the case of B4T, value propositions cluster Target Product Profile Traits with similar potential benefits. They help in (i) conceptualizing benefit projections, (ii) discussions of relative priorities of TPPs with users and stakeholders, and (iii) feasibility assessments of TPPs - the more value propositions are being pursued through the same Target Product Profile, the less progress will be made for every individual value proposition and the less feasible is meaningful impact. These groupings therefore, provide a practical handle on the substantial set of traits considered in the TPPs.

References:

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- CGIAR Breeding Portal User Manual version 5.0 [unpublished document]

About this Market Intelligence Digest

The **Market Intelligence Digest** provides concise, evidence-based guidance to support **Product Design Team (PDT) discussions** in line with CGIAR **Product Design Standards**. It synthesizes market intelligence insights to inform market segmentation, trait prioritization, and advancement decisions within existing breeding pipelines. By complementing technical breeding data, the Market Intelligence Digest helps PDTs clarify the relevance of market segments, demand signals, and adoption considerations for product design decisions.

This series is a collaborative effort of CGIAR centers and partners working on CGIAR Market Intelligence. The views and opinions expressed in this publication are those of the authors and are not necessarily representative of or endorsed by CGIAR.

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