Dalberg

# Commercialization assessment: Pearl Millet in India

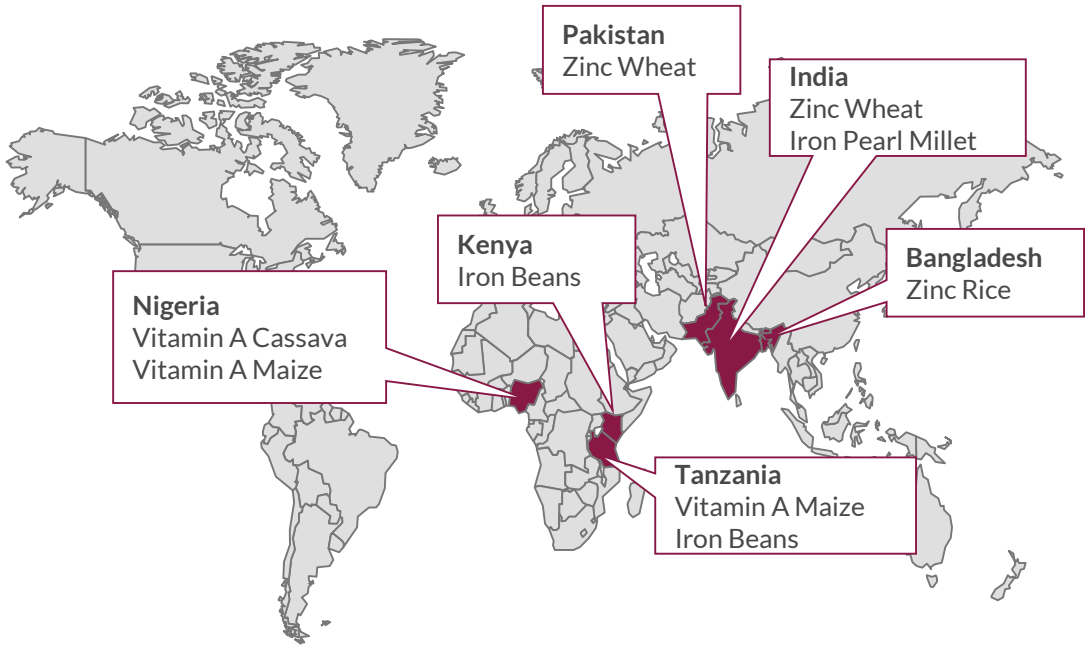
FINAL REPORT FOR GAIN AND HARVESTPLUS

DECEMBER 2019

# Recap: Programme context

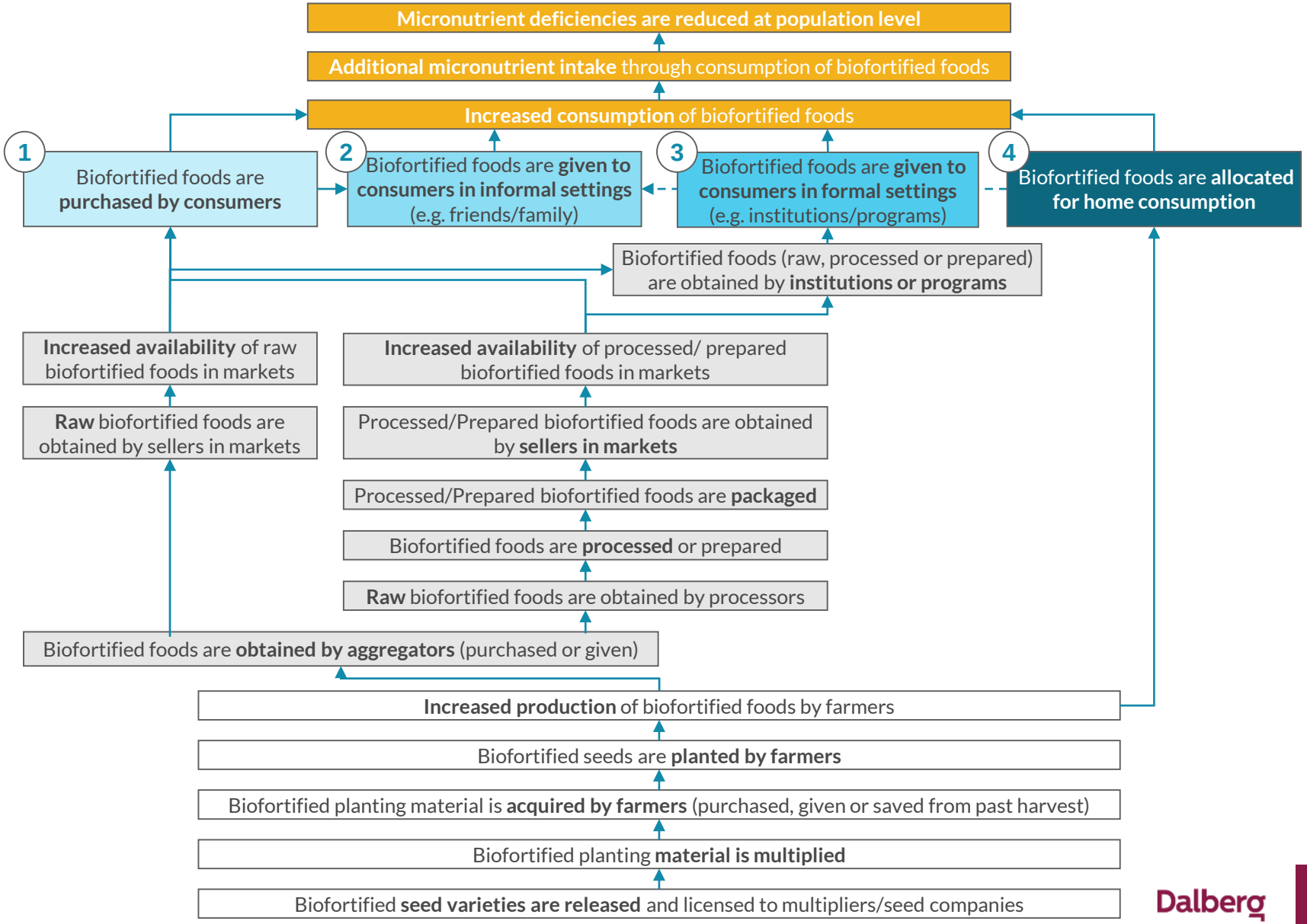
- GAIN and HarvestPlus share an ambition to expand coverage of biofortified nutrient dense foods to at least 200 million consumers. The overall vision of this program is to scale up the commercialization of biofortified foods. Iron Pearl Millet in India is one of the nine selected crop/country combinations under this programme.

- In parallel to the GAIN and HarvestPlus teams jointly developing country-level strategies for commercialization, Dalberg is conducting assessments of the potential for scale/commercialization of Iron Pearl Millet in India. This is the draft assessment report, based on literature review, interviews with relevant stakeholders, and a small number of focus groups.




- This draft report is designed to fit into the GAIN-HarvestPlus planning processes. As such, it is aligned with the Programme Impact Pathways in two ways
  - The potential routes to scale are codified in terms of the Programme Pathways: 1. Biofortified foods are purchased by consumers, 2. Biofortified foods are given to consumers in informal settings (e.g. friends/family), 3. Biofortified foods are given to consumers in formal settings (e.g. institutions/programs), 4. Biofortified foods are allocated for home consumption
  - The report focuses on barriers to commercialization, rather than being a systematic and comprehensive report of all aspects of the value chain.

# Recap: Programme Impact Pathways



# What is commercialization?

Commercialization can be thought of in three ways:

1. **An end state.** This would see the programme drive towards an end state which *is* commercial (does not require ongoing subsidy) even if the tools deployed to get there are *not* commercial themselves e.g. provision of grants for value chain actors[1]. Pathway 3, for example, might fall outside of this definition if public procurement was used to purchase and subsidize biofortified crops for the poor.

2. **A set of levers or intervention modalities.** This would include using market-based tools e.g. access to finance, strengthening value chain linkages, etc. as ways to drive scale, even if the biofortified crop itself was *not* sold [but consumed on farm]. This understanding could mean that all four Pathways are 'commercial', as long as the seed is sold to farmers in Pathway 4.

3. **A a subset of the programme Impact Pathways.** GAIN's definition, for this programme, is that "Commercialization shall be defined as the process of introducing a new product into commerce or making it available in the market, rather than producing solely for family consumption." This would mean that Pathway 4 is only relevant for its role in production of crops for sale.

The Dalberg assessments do not take a position on which of these is the most appropriate framing for the programme, rather seek to lay out "*If* GAIN and HarvestPlus want to pursue [Pathway 1-4], *then* these are the barriers, and this is what might be required".

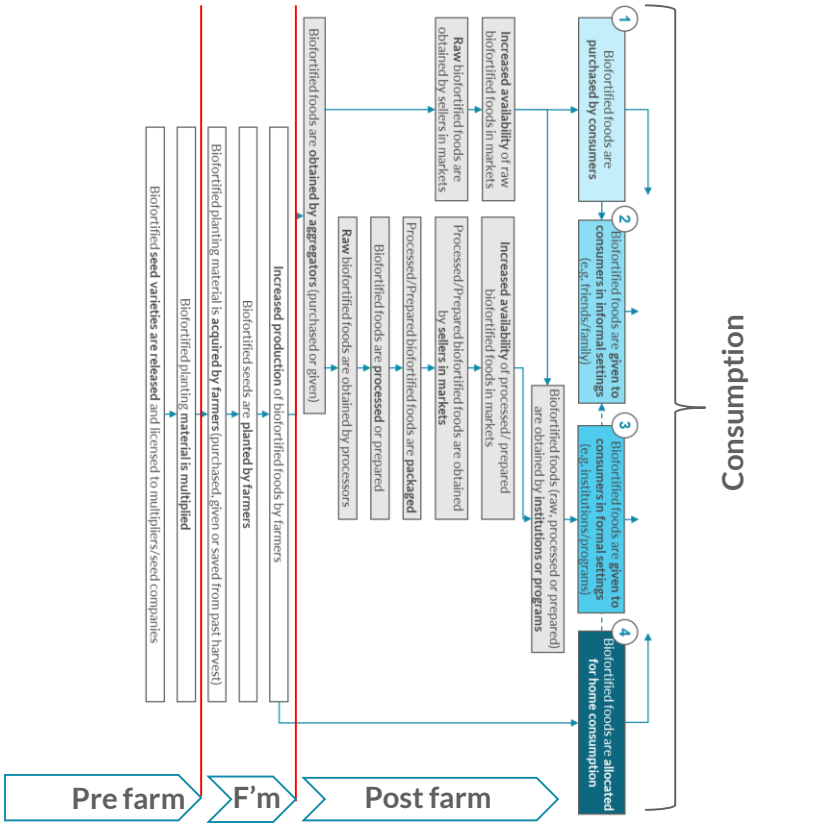
Alignment on the understanding of commercialization will potentially have significant impacts for scale that is feasible, programming, and resource allocation across the portfolio, amongst other things. On farm consumption and public procurement are significant parts of the value chains for a number of the crops under consideration.

Note(s): 1. With the expectation that after the grant, no further subsidy is needed because the market failure is corrected

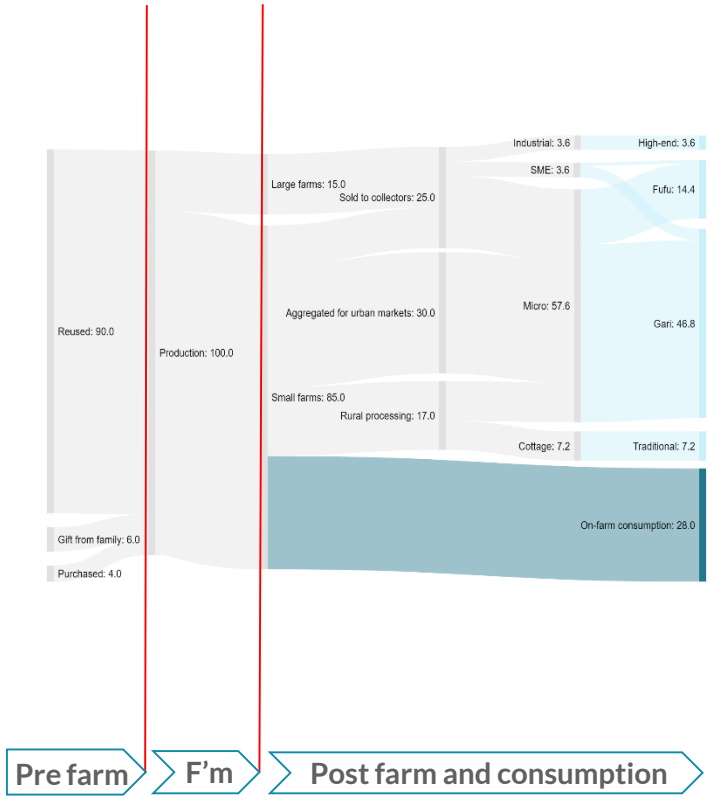
# How to read this report (1/2)

This report assesses the potential for commercialization of the crops through the programme Pathways. This page highlights how the pathways correspond to a crop value chain. Note below right that there may be >1 'channel' for each Pathway e.g. biofortified foods could be purchased through a number of value chains. Note also that not every Pathway might be material for each crop e.g. Pathways 2 and 3 are not listed below right.

## Conceptual outline of the value chain



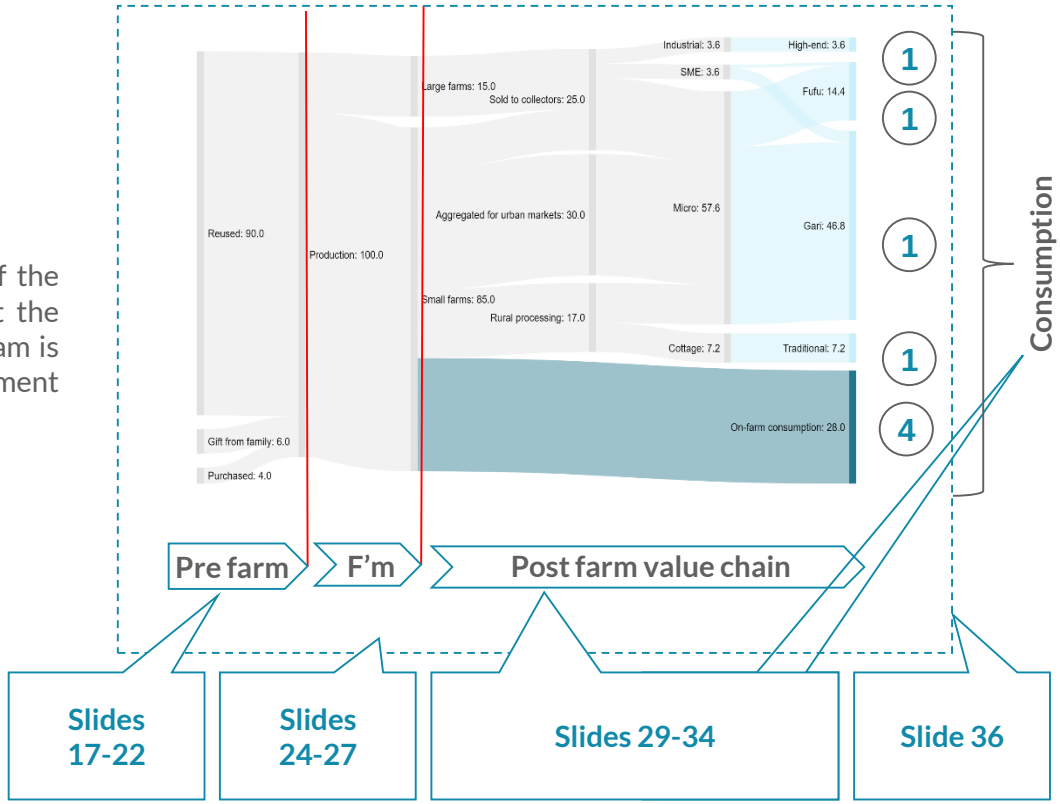

## 'Sankey diagram' showing relative flows through the value chain



# How to read this report (2/2)

- This report is broken down into six sections:
  - Executive summary
  - Pre farm value chain
  - On farm
  - Post farm value chain and consumption
  - Policy

- The barriers Dalberg identifies at each stage of the value chain should align with and complement the 'Contextual analysis' and 'Barriers' that each team is feeding into the Country Strategy Development template



# Executive Summary

# **Iron pearl millet**: Overview (1/2)

**Summary:** *New government regulation will enable iron pearl millet (IPM) to capture about 85% of the commercial pearl millet market, a major victory for biofortification. Consumption of IPM is likely to grow further through pearl millet's inclusion in the Public Distribution System (PDS). GAIN and HarvestPlus should advocate for distribution at scale in the PDS, and push to include IPM in additional procurement schemes. Pearl Millet is also gaining popularity in the health foods market. Further, GAIN and HarvestPlus can help increase consumption more incrementally by supporting foods companies in creating a market for processed pearl millet.*

- **Iron is critical to maintaining healthy blood and avoiding anemia; iron deficiency is widespread in India.** Iron deficiency is the most common cause of anemia, which can lead to maternal mortality, child stunting, and other health challenges. An estimated 30% of adult males, 45% of adult females, 80% of pregnant females, and 60% of children in India are iron deficient. Largely due to this deficiency, India suffers from the highest prevalence of anemia in the world, at 40% of the population.[1]

- **Pearl millet is a staple crop for many communities in several states throughout India.** The crop has typically been most popular in semi-arid regions where other cereals, such as wheat and rice, are more to difficult to grow. As of 2010, three states accounted for 90% of pearl millet production and consumption, Gujarat, Haryana, and Rajasthan.[2] Other states where the crop is often consumed include Karnataka, Maharashtra, and Uttar Pradesh. Where it is popular, daily consumption may be as high as 300 grams per day. Daily consumption of 160 grams of IPM flour has been found to meet 70% of daily iron needs.[3] HarvestPlus estimates that the share of the target population for pearl millet is highest in Rajasthan, Gujarat, Haryana, Maharasthra, and Uttar Pradesh.[4]

- **HarvestPlus has thus been developing biofortified varieties of iron pearl millet (IPM). IPM has been shown in trials by HarvestPlus to provide up to 80% of daily iron needs.** In states with high pearl millet consumption, IPM has potential to reduce iron deficiency at scale. Currently, IPM is in an introductory stage, with just 100,000 farming households planting the crop on 70,000 hectares of land.

Source: (1) Selvamuthukumaran, S. "A Clinical Study of Severity of Anaemia in Adults," *Inrternational Journal of Contemporary Medical Research*, Volume 5, 2018 Dec (2) HarvestPlus, "Country crop profile: Iron pearl millet in India," 2010 (3) Cercamondi, C., et al, "Total Iron Absorption by Young Women from Iron-Biofortified Pearl Millet Composite Meals Is Double That from Regular Millet Meals but Less Than That from Post-Harvest Iron-Fortified Millet Meals," *The Journal of Nutriton.* Volume 143, Issue 9, 2013 (4) Funes Jose, Birol Ekin, Moursi Mourad and Manfred Zeller, "Subnational BPI – India" HarvestPlus, IFPRI, 2016 July

# **Iron pearl millet**: Overview (2/2)

- **To assess the potential for commercialization of IPM, we focused our analysis on three existing market segments, and one market segment soon to be developed.** The three existing segments are (i) on farm consumption, which is 35% of the total market (and potentially out of scope of the GAIN and HarvestPlus programme), (ii) rural consumption, which is 20%, and (iii) urban consumption which is 5%. The government does not currently sell pearl millet to end consumers, but the crop has been added to India's public distribution scheme (PDS) and we expect that in 2-3 years government procurement will claim significant share in areas where pearl millet is presently consumed.
- Rounding out the market are the animal consumption segment (e.g. beer, poultry feed) at 30% of the total market, and the non-food industrial segment (e.g., beer, animal feed), at 10%. We have not explored these segments as their role in increasing human iron intake is likely to be minimal.
- **The IPM market has already received a major boost through recent government regulation, and future government procurement should grow it further.** In 2018, the Indian Council on Agricultural Research (ICAR) mandated that all newly released hybrid pearl millet seed must be biofortified to a minimum standard of 42 parts per million (PPM) iron. Several stakeholders have indicated that that within five years close to all hybrid seeds will reach this standard because of the short life cycle of hybrid varieties. Based on the distribution of hybrid and open pollinated varieties (OPVs), we estimate biofortified seeds will account for ~60% of on-farm consumption, and ~85% of rural and urban consumption (the balance of consumption being non-biofortified OPVs).
- **Moreover, we expect the overall market for pearl millet to grow due to its recent inclusion in the PDS.** Although there will be some substitution effect, low prices offered consumers through the PDS will likely increase consumption on net. Details are still to be worked out by the government and it is not yet possible to estimate the size of the increase expected.

Source: Stakeholder consultations; Dalberg analyses

# **Iron pearl millet**: Barriers to commercialization (1/2)

- **While these developments are positive, barriers constrain IPM from capturing more of the pearl millet market and competing in the processed food market.** One main barrier is cross-cutting but affects on-farm consumption in particular. Another main barrier is specific to urban consumption.

  Main barriers *cross-cutting* all the market segments:

  1. **No competitive biofortified alternative exists for farmers using OPVs.** 40% of pearl millet farmers plant OPVs and are unlikely to switch to (biofortified) hybrid varieties in the near future. They generally either lack access to enough water to farm hybrids or prefer the OPV taste profile. Biofortified OPVs may be appealing to these farmers in theory; however, those developed to date have performed poorly on yield and other farmer decision drivers. As a result, OPV farmers will likely continue to use analogue varieties. Pearl millet from OPV seeds is largely consumed on-farm, and we expect that 15% of the commercial market will remain non-biofortified.

  Main barriers specific to *urban consumption*:

  2. **Pearl millet's short post-grain shelf life and immature supply chain have prevented processors from using the grain to develop products.** While major processors would be interested in processing and packaging pearl millet, shelf life is a barrier to product development. Some packaging solutions exist but processors still highlight shelf life as a challenge that needs to be overcome.[1] Consequently, pearl millet is consumed mostly as freshly baked bread (though some puffs and cookies produced by smaller processors are also consumed). This barrier reduces the potential addressable market size of rural and urban consumption.

Note: (1) Higher costs of present solutions can potentially explain the contrast, although this will need to be confirmed with processors through stakeholder interviews
Source: Stakeholder consultations; Dalberg analyses

# **Iron pearl millet**: Barriers to commercialization (2/2)

- Looking beyond the quantity of biofortified varieties consumed, GAIN and HarvestPlus may also want to consider the quality of the varieties. There is one barrier to commercializing varieties that provide greater daily intake of iron:

3. **Limited incentives of seed producers to exceed ICAR's iron biofortification minimum.** As mentioned, the IPM mandate is for new hybrid seed to reach an iron content of 42 PPM. While this level would represent a significant improvement over non-biofortified varieties, HarvestPlus indicated that seeds biofortified with ~70 PPM of iron would be optimal for eliminating iron deficiency.[1] However, reaching higher levels of iron content requires significant R&D and smaller seed companies lack the capacity or incentive to invest in it. As there is no distinct market for IPM creating demand for varieties with high iron content, most seed companies are likely to develop varieties that meet but do not exceed ICAR's minimum requirement.

Note(s) (1) There are no studies directly comparing 42 PPM IPM with 70 PPM IPM. One study comparing the effect of pearl millet with 24 mg Zn/ and IPM with 41 mg Zn/g found that the latter increased absorption of iron by 33%. [Rosado, J; et al "The Quantity of Zinc Absorbed from Wheat in Adult Women Is Enhanced by Biofortification"]

# **Iron pearl millet**: Recommended interventions (1/2)

- **As a first priority, we recommend GAIN and HarvestPlus support expansive pearl millet distribution through the PDS and other procurement schemes.** The PDS offers the potential for large scale up of pearl millet. For example, 28% and 39% of wheat and rice consumption, respectively, is through the PDS[1]. For pearl millet, most procurement is likely to be of IPM varieties, as hybrid farmers are more likely than OPV farmers to be suppliers. Pearl millet has already been designated for inclusion in the PDS. Given the potential size of this channel, there could be a large return on lobbying for expansive pearl millet distribution and supporting the success of operationalizing procurement by providing technical support. For example, GAIN and HarvestPlus can share expertise on analysis on potential sourcing channels, populations with high biofortification prioritization index scores, and standards around handling and storage. There may also be a future place for pearl millet in other public programs, such as the Integrated Childhood Development Scheme and Mid-day Meals Programme. Lobbying for inclusion of pearl millet in these channels should be explored.

- **As a second priority, we recommend that GAIN and HarvestPlus work to grow the overall pearl millet market by partnering with food processors to develop a pearl millet products targeted at health conscious urban consumers.** One negative of pursuing the health conscious urban sub-segment is that it is niche – composed of approximately 90 million people. In addition, most of the individuals in this sub-segment will be less affected by iron deficiency than in other segments. On the other hand, the purchasing habits of this high end sub-segment may gradually trickle down to less affluent customers and help create a mass market for unbranded IPM products. Flavored yogurt in India serves as a good example – its was offered initially by high-end processors such but now is sold by mass producers such as Mother Dairy at relatively much more affordable prices.

- A pre-condition to growth of the pearl millet processed food category is solving the shelf life issue. Currently, ICAR and Corteva are conducting R&D on IPM varieties capable of shelf lives greater than six months. According to stakeholders, a breakthrough is expected within the next year. This development would open the door for the IPM processed foods market, potentially increasing the pearl millet market size by 1-2 percentage points (if demand equaled 20-40% of current urban consumption of pearl millet flour).

Source: (1) Based on NSSO data - in 2009-10, 39% and 28% households reported consuming rice and wheat respectively through PDS

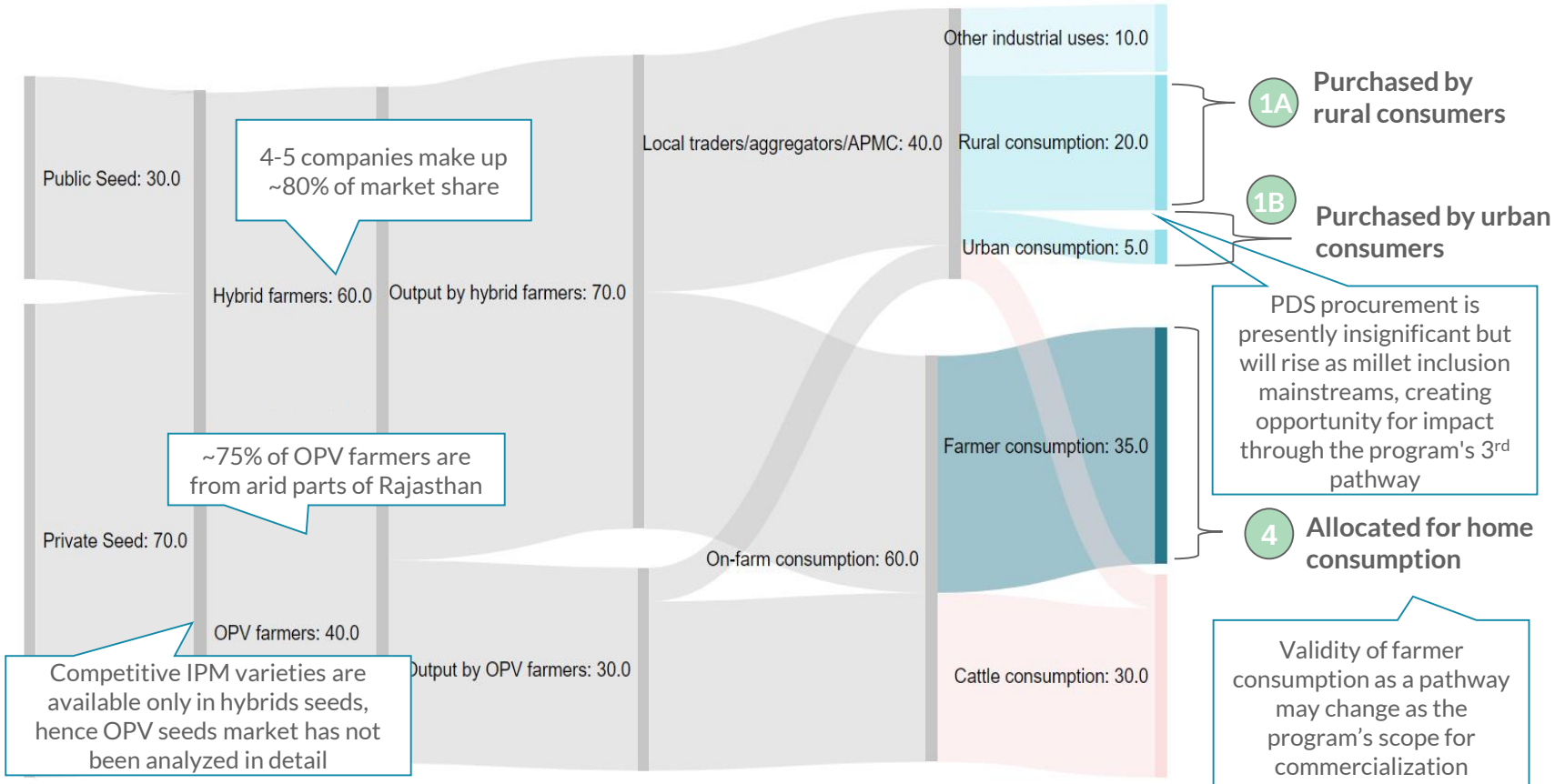
# **Iron pearl millet**: Recommended interventions (2/2)

- To facilitate market entry by processors, GAIN and Harvest Plus can (i) build partnerships with processors, seed producers and farmer groups to develop value chains, and (ii) support product development with processors. The Indian Institute of Millet Research is already interested in this area and joint efforts may accelerate development and adoption by processors.
- This intervention would address Barrier 1 by strengthening the pearl millet supply chain while leveraging technical improvements in shelf life.
- **Finally, GAIN and HarvestPlus may consider interventions to promote adoption by smaller seed companies of high-iron varieties of pearl millet.** Major private sector seed companies (such as Corteva and Bayer) are already developing new varieties with high PPM levels in anticipation of the market moving toward higher levels of enrichment. However, smaller seed companies are less likely to be as forward looking. GAIN and Harvest Plus could help these companies leapfrog to higher levels of biofortification by making available a non-exclusive ready-variety of breeder seed. This intervention would address Barrier 3 by reducing or eliminating the investment seed companies need to make to sell highly biofortified hybrids.

Source: Stakeholder consultations; Dalberg analyses

# IPM's commercial pathways are rural and urban consumption, and soon-to-begin distribution through the PDS

Pearl Millet is a staple crop across six populous states in India. It is primarily consumed by farm households and used as a source of animal fodder. There are few applications as a processed food. Overall consumption has dropped across segments over recent decades, but government's revitalized focus on millets may change this trend. Pearl millet has also been included in the PDS procurement system in 2018, and the implementation is in early stages.




Source: Stakeholder consultations; Dalberg analyses

# GAIN and HarvestPlus should advocate for distribution at scale in the PDS and partner with foods companies

| | Objective | Pathway(s) | Addressable market(s) | Illustrative GAIN and HarvestPlus activities |
|---|---|---|---|---|
| **Short to medium term recommendations** | | | | |
| *Support government procurement* | New market development | 1A 1B Consumption through PDS | 30-40% rural households | • Lobby for wide pearl millet distribution in areas of high demand<br>• Provide technical support on PDS operationalization and lobby for |
| | | 3 Consumption through ICDS and mid-day meal scheme | 190 million women and children under 6 | |
| *Partner with packaged foods companies* | New market development | 1B Urban consumption by health conscious sub-segment | 90 million health conscious consumers | • Develop integrated supply chain with seedcos, farmers, and processors<br>• Support development of new pearl millet product lines<br>• Support R&D on increased shelf life |
| *Promote adoption by smaller seedcos of high-iron varieties* | Improved quality | Cross-cutting | <20% of hybrid seed market | • Identify varieties to promote<br>• Facilitate contracts between small seedcos and research or public institutions |
| **Potential long term recommendations** | | | | |
| *Convert OPV farmers to biofortified hybrids (once irrigation access expands)* | Market share growth | 4 Mainly on-farm consumption[1]; cross-cutting | 40% of on-farm consumption | • Offer on-farm production support<br>• Provide financial support for seed purchases |
| *Advocate for higher iron content minimum (after further seed market development)* | Improved quality | Cross-cutting | 60% on-farm consumption and 80% commercial consumption | • Lobby ICAR on minimum standards for approval<br>• Conduct research to establish health case for higher iron content |

Note(s): (1) Potentially out of scope of the GAIN-HarvestPlus programme
Source: NSSO, 'Public Distribution System and Other Sources of Household Consumption – 2010', 2013; FSSAI 'Large scale food fortification in India' 2017; NIELSEN, 'India Acquires A Taste For Health And Wellness', 2019; Dalberg analyses

# Pre-farm

# In addition to their health benefits, IPM seeds compete well on hedonic factors, such as taste

An RCT conducted in Maharashtra (2012) tested the willingness to pay for biofortified iron pearl millet by measuring consumer preferences across three treatment groups. Group A was a control group that was unaware of the biofortified variety, while treatment groups B and C were explained the importance of iron in diets and were aware of the biofortified variety. Group B was told HarvestPlus, an international health authority, developed the IPM, while Group C was told it was developed by a fictional state-level health authority "*Samarth*".

**Control Group (A)** **"Blind test"**

Even without prior knowledge to the nutritional benefits of iron and awareness of the biofortified variety, consumers show a preference for the sensory attributes of both biofortified pearl millet grain and bakhri.

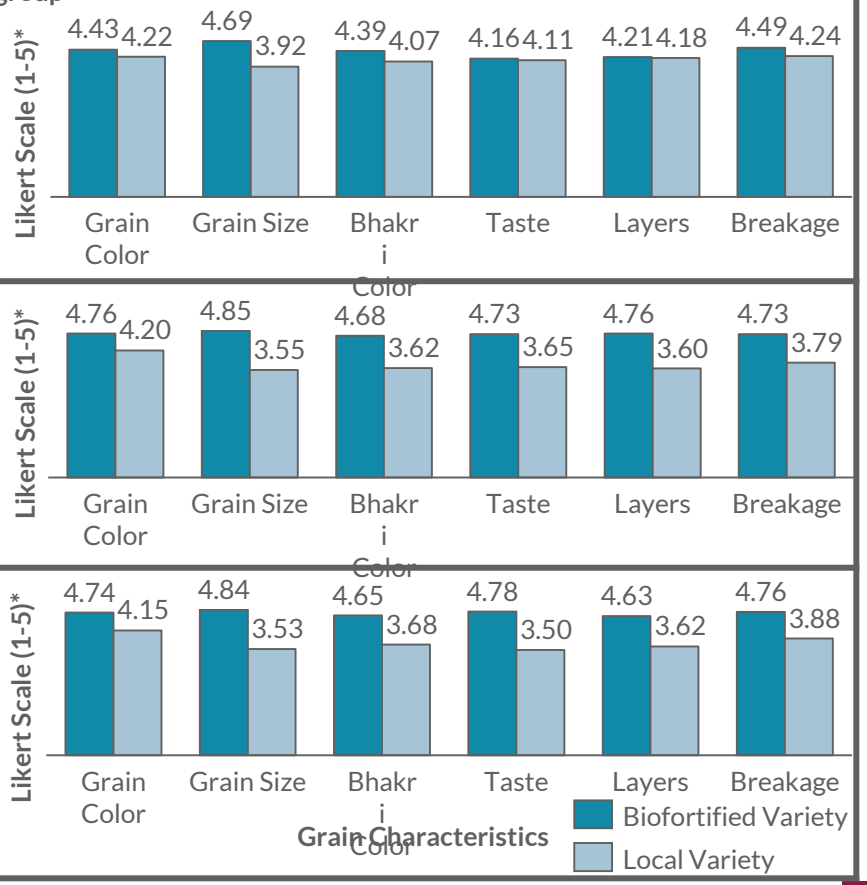
**Treatment Group (B)** **International Certification**

After an infomercial about the importance of iron for nutrition, participants took part in the sensory evaluation and showed a stronger liking to the iron pearl millet variety than the control group who had no knowledge of it.

**Treatment Group (C)** **State-level Certification**

Based on similar ratings between treatment groups B and C, the role of the certifying authority or branding of the product does not seem to have a significant impact on respondents' evaluation of the biofortified variety.

**Mean sensory characteristics and comparison of pearl millet, by treatment group**




Source: (1) HarvestPlus, "Working Paper 17: Information, Branding, Certification, and Consumer Willingness to Pay for High-Iron Pearl Millet: Evidence from Experimental Auctions in Maharashtra, India", 2015.; (2) HarvestPlus, "Working Paper 24: Understanding the Adoption of High-Iron Varieties in Maharashtra, India: What Explains Popularity?", 2015.

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# Still, IPM seeds have been adopted by only ~100k farmers

| Iron Pearl Millet | |
|---|---|
| **Delivery stage** | • 2nd Wave varieties in late stages of commercial approval process |
| **Number of varieties released** | • 11 varieties available in India<br>• 4 varieties officially released<br>• 2 varieties commercially available by Nirmal Seeds and Shakti Vardhak |
| **Reach** | • Adoption by ~100,000 farmers |
| **Volumes** | • Cultivated on 70k hectares of the 9.3 mn hectares used for pearl millet |
| **Agronomic characteristics** | • Competitive varieties available only in hybrid seeds as of now<br>• Yield ~10-15% lower in case of Wave 1 varieties compared to other commercial hybrids, but Wave 2 expected to be competitive |
| **Other characteristics** | • 70 PPM+ iron content in few iron-enriched varieties<br>• Current varieties test well on hedonic factors |

**Biofortified market composition**

- Currently a distinct market for biofortified crops does not exist; producers view IPM as competitive analogue seeds with high iron

**Comparison of hybrid (and biofortified) varieties to OPV**

- ✓ Yields: Significantly higher yield in case of hybrids
- ✓ Uniformity: Standardized output
- × Cost: ~3x higher seed cost compared to OPV
- × Reusability: Necessitates annual purchase
- × Taste: Identified as bitter by OPV farmers
- × Input need: Require significantly more water for cultivation

**Biofortified seed characteristics**

- HHB 299 (Hybrid)
  - High iron (73.0 ppm) and zinc (41.0 ppm) compared to 47 PPM baseline[1]
  - Grain yield: 32.7 q/ha
  - Dry fodder yield: 73.0 q/ha
  - Maturity: 81 days
- AHB 1200
  - Rich in iron (73.0 ppm) compa
  - Grain yield: 32.0 q/ha
  - Dry fodder yield: 70.0 q/ha
  - Maturity: 78 days

Upcoming mainstream biofortified varieties may not necessarily offer such high level of iron content

**Future releases**

- Most new varieties in future expected to be biofortified with at least 42 PPM iron content, while being competitive to analogue hybrid varieties

Note(s): (1) Harvest plus baseline of 47 PPM is calculated using simple mean for the available hybrid varieties, not taking into account the market share, and therefore is likely to be an overestimation

Source: Government of India, "Evaluation Study on Role of Public Distribution System in Shaping Household and Nutritional Security India", 2016; Yadava D.K., P.R. Choudhury, Firoz Hossain and Dinesh Kumar 2017. Biofortified Varieties: Sustainable Way to Alleviate Malnutrition. Indian Council of Agricultural Research, New Delhi; Interviews with GAIN and HarvestPlus country teams

# IPM adoption will increase significantly in the future because of ICAR's mandate that new seeds must be biofortified

| | Research and development | Production and Approval | Agricultural Supply |
|---|---|---|---|
| Features | **R&D on IPM growing**<br>• 11 varieties of IPM available in India<br>• 2nd Wave varieties in late stages of commercial approval process<br>• Focus on high-iron pearl millet seed development increasing to ensure compliance with ICAR mandate that pearl millet seeds must have at least 42 PPM iron for official release[2] | **Contract farming core; Approvals necessary**<br>• Large-scale production through contract farmers, concentrated in southern states (Andhra Pradesh, Tamil Nadu, Telangana)<br>• State authority approval mandatory for sale to farmer and ICAR approval required for inclusion of seeds in govt agricultural schemes | **Significant IPM transition in 5 years**<br>• Competitive seed space marked by low cost & frequent evolution -market life of a seed variety is ~4-5 years<br>• Large seedcos influence smaller ones<br>• No distinct IPM market presently, but iron-enriched seeds expected to replace current varieties in next 5 years because of ICAR guideline |
| Actors | **Mostly public, but private growing**<br>• Public organisations such as ICAR, ICRISAT, and HarvestPlus leading R&D on IPM<br>• Market influencers such as Corteva Agriscience and Bayer CropScience are investing strongly in high-iron (>42 PPM) hybrid seed development as they see this as a future USP | **Strong private sector capabilities**<br>• Private companies are main producers at scale<br>• Public institutes lack capabilities for large-scale production in most cases<br>GAIN and HarvestPlus partners producers do not feature in the list of industry influencers | **Large seedcos dominate**<br>• ~90% hybrids produced by private companies with variation by state<br>• Ongoing consolidation of smaller seed dealers by medium and large firms is lowering competition<br>• 4-5 companies (Corteva Agriscience, Bayer CropScience, Metahelix, Mahyco, Kaveri seeds) make ~80% of the private market |
| Economics | **Limited allocation by smaller seedcos**<br>• Research budget by private companies, specially smaller ones not optimum at present | **Farmer preference for high yielders**<br>• Contract farmers prefer high-yield seed varieties for production, as they receive higher revenue when sold by volume | **No differing economics for IPM**<br>• Pearl millet seed production perceived as highly profitable<br>• Economics for iron-enriched pearl millet seeds expected to be similar to analogue seed |

Important development

Note(s): (1) Competitive IPM varieties are available only in hybrids seeds, hence OPV seeds market has not been analyzed in detail; (2) Further details on the ICAR policy have been provided in the policy and finance section
Source: Stakeholder consultations; Dalberg analyses

# This regulation will help overcome the current lack of economic incentives for seed companies to convert to IPM

***Barrier summary***

Iron-enriched pearl millet seeds do not offer any additional profits to seedcos to make the switch, and lack of a lucrative business case makes continuation of current varieties a default option

***Deterring factors***

**Lack of a market premium**

- Farmers are unwilling to pay a premium for higher iron content in seeds as no differentiated pricing exists for IPM
- Such prevailing economics and lack of demand in the market limit widespread adoption

***Enabling factors***

**ICAR regulation on iron-threshold**

- 42 PPM iron content will be mandatory in future varieties for ICAR approval
- ICAR approval allows for inclusion in future government schemes, which is a gateway to large sections of farmers
- Industry stakeholders agree that in the next five years, seedcos will transition to IPM seeds to comply with the ICAR regulation even in the absence of economic incentives
- ~70% of the current seed varieties fall below the 42 PPM threshold; reaching it will require a major R&D push

**Focus on high-iron by influencers**

- Large seedcos such as Corteva and Bayer (unlike smaller players) are developing high-iron varieties (>70 PPM) considering the long-term horizon

**Implications**

***Barrier will be solved through the regulation, but partially***

- While most new varieties are likely to have at least 42 PPM iron, going beyond the ICAR threshold will remain voluntary
- HarvestPlus aims to mainstream 77 PPM iron in the long-term; present market conditions may not help achieve that
- Introduction of seed varieties with such PPM level may not be widespread, except in the case of the largest companies

Source: Stakeholder consultations; Dalberg analyses

# But immediate development of IPM by small seedcos may not take place given limited capabilities and competing priorities

***Barrier summary***

IPM adoption by smaller companies will be particularly challenging, given their limited resources and their short-term focus

***Deterring factors***

| | |
|---|---|
| **Limited R&D capabilities** | • Smaller seedcos lack the R&D infrastructure as well as resources to develop iron-enriched hybrid varieties |
| **Low strategic priority** | • Developing iron-enriched varieties does not feature as a strategic priority for smaller seedcos given the lack of any immediate returns |

***Enabling factors***

| | |
|---|---|
| **Seeds short life-cycle** | • Current varieties will need to be replaced in a few years as their resistance to disease breaks down |
| **Potential influence of industry dominators** | • Large seedcos, who influence market trends, see high-iron as an upcoming product USP<br>• Hence, high-iron may become a competing factor for the newer hybrid varieties in future |
| **ICAR regulation on iron-threshold** | • 42 PPM iron content will be mandatory in future varieties for ICAR approval<br>• ICAR approval is valued because it allows for inclusion in govt schemes |

**Implications**

***Barrier will have low impact***

Above-mentioned barriers may prolong the adoption period for smaller seedcos, but market influences are likely to push them to develop 42 PPM varieties in the short to medium term

Source: Stakeholder consultations; Dalberg analyses

# **Opportunities:** Strong opportunity exists for GAIN and HarvestPlus to accelerate adoption of high-iron varieties by smaller seedcos

Immediate opportunity | Long-term opportunity

| Intervention area | Description | Importance |
|---|---|---|
| **Promote adoption by smaller seedcos of high-iron varieties** | • GAIN and HarvestPlus can accelerate IPM adoption by smaller seedcos by making high-iron, competitive varieties available to them for commercialization<br>• Improved seed quality is likely to take precedence over exclusivity for smaller seedcos, unlike in case of large seed companies and hence opportunity may exist<br>• GAIN and HarvestPlus can help identify such varieties and matchmake between the public institutions, which hold rights to high-potential varieties, and the smaller seedcos that have capacity to achieve scale<br>• Through this intervention, GAIN and HarvestPlus can even support leapfrogging to IPM varieties with target iron level (77 PPM) if such competitive varieties can be commercialized<br>• Ensuring ready access to sufficient quantities of such varieties for internal testing and commercialization by seedcos will be necessary to popularize adoption<br>• Seedcos operating in high iron deficiency regions may also be targeted to have maximum impact as pearl millet is likely to be consumed in the same region where it is grown given its short shelf-life | *High* |
| **Advocate for a higher PPM threshold** | • GAIN and HarvestPlus can lobby ICAR to raise the 42 PPM threshold to a higher standard as the industry capability improves<br>• Further research to establish the health case for higher iron content in pearl millet can also be conducted | *Medium* |
| **Continue support for germ plasm** | • GAIN and HarvestPlus can provide access to high-iron germ plasm to medium and large seed companies to support their R&D efforts in IPM seed development<br>• Further reducing procurement costs can also be explored to support widespread adoption | *Medium* |

**INITIAL HYPOTHESES FOR DISCUSSION DURING DUBAI WORKSHOP**

Source: Stakeholder interviews; Dalberg analyses

# On farm

# Farmers sowing pearl millet can be segmented into three archetypes based on seed choice and access to water

## 1 Well Resourced *(10%)*

*Wealthy farmers who use irrigation to grow hybrid pearl millet in the summer (dry) season*

**Farmer characteristics**
- Located mostly in northern Gujarat
- Rich and have high investment appetite
- Have access to sufficient irrigation facilities
- Produce mostly in summer season

**Seed use**
- Use 100% hybrids for higher yields

**Decision drivers**
- High yield
- Lodging tolerance[1]
- Disease resistance

**Consumption choices**
- ~50% produce consumed on-farm and ~50% sold in market

**Key influencers**
- Private seed company representative and distributors

## 2 Resource Conservative *(40%)*

*Small and marginal farmers in areas with moderate rainfall (or with some access to irrigation) who grow hybrid millet in the rainy season*

**Farmer characteristics**
- Located in UP, MP, Maharashtra, Karnataka, Eastern Rajasthan etc.
- Economically better-positioned compared to low-income farmers
- Rain-dependent, but irrigation water available in some cases
- Produce only in rainy season

**Seed use**
- Use 100% hybrids for greater yield

**Decision drivers**
- 70-90 day crop maturity preferred as it matches water availability and provides better quality output
- High yield
- Lodging tolerance
- Disease resistance

**Consumption choices**
- ~50% produce consumed on-farm and ~50% sold in market

**Key influencers**
- Influential farmers and private seed distributors

## 3 Resource Constrained *(50%)*

*Small and marginal area farmers in arid or semi-arid areas who grow OPVs in the rain season*

**Farmer characteristics**
- Low-income farmers
- Located mostly in water-scarce areas[2] such as western Rajasthan
- Largely rain-dependent
- Produce only in rainy season
- Certain section has strong taste preference for OPV produce

**Seed use**
- ~80% farmers purchase and re-use OPV seeds as hybrids are unsuitable in water-scarce regions
- ~20% farmers still use hybrids

**Decision drivers**
- <70 days maturity and OPV seeds preferred to minimize water needs
- Need high fodder quantity from harvest

**Consumption choices**
- ~80% produce used on-farm for self-consumption and fodder

**Key influencers**
- NGO workers & influential farmers

Note(s): (1) Lodging is defined as permanent displacement of aboveground parts as per (mostly due to strong winds); (2) Areas receiving less than 400mm rainfall;
Source: Stakeholder consultations with representatives from Bayer CropScience, Seedworks, ICAR – AICRP; Dalberg analyses

1
2

# Well resourced and resource conservative farmers will switch to IPM as the hybrid market transitions to biofortified seeds

| | Present | Short-term *(2-3 years)* | Long-term *(>5 years)* |
|---|---|---|---|
| **Production** | • 100% production using hybrids seeds | • Some farmers shift to biofortified hybrid seeds as seedcos transition | • Majority of farmers use biofortified hybrids as IPM mainstreams |
| | | *Automatic transition* | |
| **On-Farm Consumption** | • 100% on-farm consumption of pearl millet produced using hybrid seeds | • Partial shift in on-farm consumption towards iron pearl millet as farmer adoption increases | • Majority of farmers consume iron pearl millet as most farmers adopt biofortified varieties |

***The adoption period for these farmers can be reduced further through on-ground interventions they are receptive to***

**Awareness building**

- Seed choices of well resourced and resource conservative farmers can be influenced through on-ground interventions pushed through influencers, such as seedco representatives and local influencers
- Production on demonstration plots, adoption by influential farmers, and on-farm awareness initiatives can help build credibility and trust for IPM seeds and help with farmer adoption

*Interventions for well resourced and resource conservative farmers to convert to IPM are not necessary in the long-term, but GAIN and HarvestPlus can potentially intervene to accelerate adoption through on-ground interventions*

Note(s): (1) 42 parts per million (2) Parts per million
Source: Stakeholder consultations; Dalberg analyses

Dalberg

3

# Resource-constrained farmers will likely continue to use non-biofortified OPVs; conversion to IPM may not be feasible

## Challenges to Adoption for Resource-Constrained Farmers

### Lack of competitive IPM varieties in OPV seeds

- Lack of competitive iron-enriched OPV varieties inhibit direct adoption; attempts at developing iron-enriched OPV varieties were made in the past but such varieties offered lower yield, and hence adoption has not been successful

### Low Water Availability

- Production practices of resource-constrained farmers are influenced by water availability, as they are located in regions receiving less than 400 MM rainfall and they do not have irrigation facilities
- Competitive IPM seeds in hybrid varieties have higher water needs compared to OPV seeds, and therefore adoption of IPM may not be feasible by farmers in case of low water availability
- Irrigation and infrastructure projects by the central and state goverment such as 'Per drop more crop' and 'Indira Gandhi Canal' may change the water availability conditions, but could take up to 5-10 years or even more

### Taste Preferences

- Resource-constrained farmers, the majority of whom are located in Western Rajasthan, have a strong taste preference for pearl millet produced using OPV seeds, and feel pearl millet from hybrid varieites tastes bitter
- Such ingrained food preferences are hard to change and may not fall under the GAIN and HarvestPlus program objectives

## Limited scope for intervention in the short-term

### Limited opportunity to intervene until water availability increases

- GAIN and HarvestPlus may not have a significant role to play unless the water availability challenge is addressed
- Government or multi-laterals are more suited for large-scale irrigation projects than GAIN and HarvestPlus, given their respective expertise areas and resource levels

### Private sector likely to pursue hybrid adoption in the interim anyway

- Private seedcos have both the intent and resources to conduct on-ground interventions to support the switch from OPV to hybrid seeds, even in water-constrained situations, to increase their market share
- When the switch happens, it will most likely lead to IPM adoption given the anticipated IPM mainstreaming in next few years

*We do not recommend GAIN and HarvestPlus intervene in the short term*

Source: Stakeholder consultations; Dalberg analysis; Dalberg analyses

# **Opportunities:** Interventions may target well resourced farmers for "quick win" supply chain building with private sector

Immediate opportunity | Long-term opportunity

| Intervention area | Description | Importance |
|---|---|---|
| **Target well resourced farmers to support downstream adoption by private sector** | • Well resourced farmers are characterized as progressive, and resourceful, having high per hectare output (6-8 tons compared to avg. yield of 1-1.2 tons)<br>• Supply chains need to be developed to allow for private sector adoption by branded products, and well-resourced farmers may be best-suited to support it<br>• GAIN and HarvestPlus can focus on adoption of IPM by well resourced farmers to support with interventions in the post-farm part of the value chain | *High* |
| **Accelerate IPM adoption amongst well resourced and resource constrained farmers** | • This intervention may not be necessary in the long-term, but can help reduce the adoption period in the interim if GAIN and HarvestPlus wish to do so<br>• Adoption can be accelerated through promotion of IPM varieties over other hybrid varieties through on-ground interventions<br>• Interventions could include increasing farmer awareness, targeting influential farmers leading to spillover effect on other farmers, and setting up demo plots for IPM<br>• Such on-ground activities are already being undertaken by HarvestPlus, and continuation of those should be sufficient | *Medium* |
| **Support conversion of OPV farmers to hybrid farmers in the future** | • GAIN and HarvestPlus can focus on conversion of OPV farmers to hybrid seed users once water availability as a barrier is taken care of<br>• Interventions for improved access to IPM seeds, on-farm production support, and financial assistance for seed purchase can be explored to complement private sector initiatives in the domain | *Medium* |

*Linked with post-farm recommendation to partner with private processors*

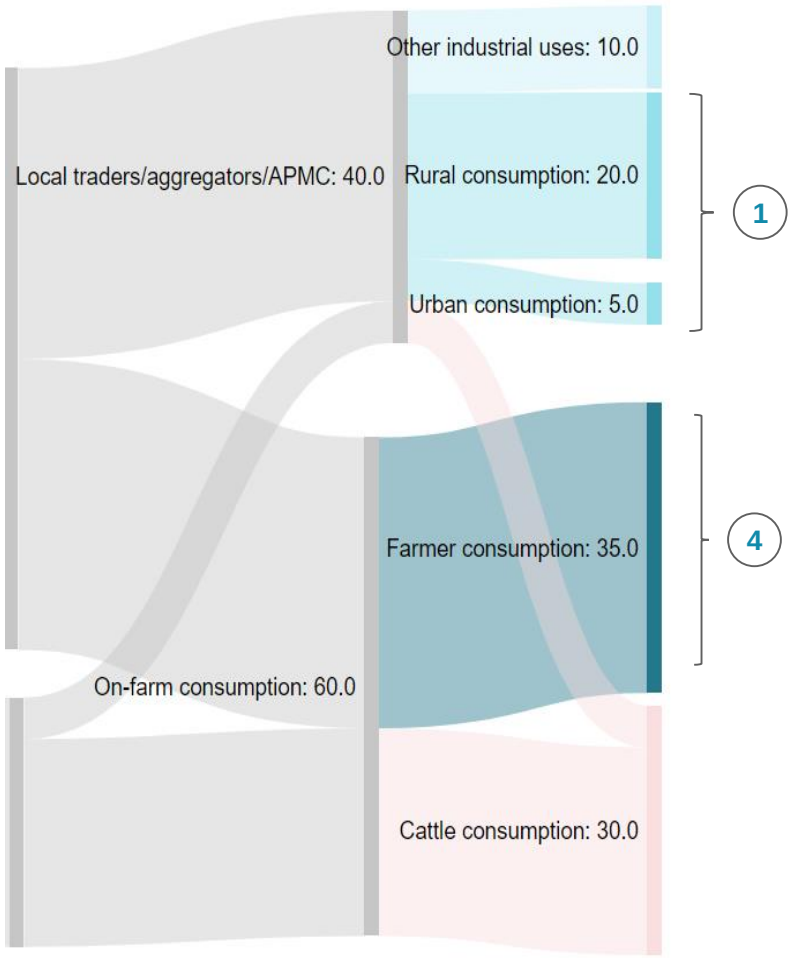
*Well resourced farmers can play an important role in driving the private sector opportunity; IPM adoption by them can directly impact the private sector pathway*

**INITIAL HYPOTHESES FOR DISCUSSION DURING DUBAI WORKSHOP**

Source: Stakeholder interviews; Dalberg analyses

# Post-farm value chain and consumption

# While five pathways exist for end-use of pearl millet, only three are relevant for direct human consumption




De-prioritized segments

**1A Rural consumption**

- Locally sourced unbranded pearl millet, sourced from local players and sold by retailers

**1B Urban consumption**

- Urban consumption: Branded and unbranded pearl millet sourced by traders, aggregators, and APMC[1] and sold by urban retailers

**4 Farmer consumption** (potentially outside of programme scope)

- Pearl millet produced and stored by farmers for self-consumption

**Cattle consumption**

- Pearl millet used as feed for cattle; most of which is directly used by farmers for their own cattle
- Small portion is procured by non-millet farmers for feeding their cattle through local markets

**Industrial uses**

- Pearl millet sourced for industrial uses such as beer production or poultry breeding
- Poultry breeding accounts for 8% of the total 10%

*Increasing pearl millet consumption through non-human and industrial channels is unlikely to impact micro-nutrient deficiencies in humans, and therefore these avenues have been de-prioritized*

Note(s): (1) Agriculture Produce Market Committee
Source: Stakeholder consultations

# The PDS and urban processors are high potential pathways; on-farm consumption may be a non-commercial opportunity

High potential pathway

## 1A Rural consumption

### Pathway 1: PDS procurement
*Used mostly by low-income consumer*
- ✓ Wide network and caters to significant population
- ✓ Reaches most vulnerable populations and, therefore, high nutritional impact
- × Low commercialization opportunity as prices are highly subsidized

### Pathway 2: Local Millers
*Used by consumers of all income levels*
- ✓ Better commercial opportunity compared to PDS
- × Food preferences of consumers shifting to finer grains such as wheat and rice with income increases
- × Fragmented channel, therefore multiple sets of interventions required

## 1B Urban consumption

### Pathway 1: Private Processors
*Used mostly by middle to high-income consumers*
- ✓ Purely commercial channel
- ✓ Diet diversity and healthier food alternatives are an upcoming trend for health-conscious consumers
- × Limited scale presently
- × Low nutritional need

### Pathway 2: PDS
*Same considerations as Rural PDS*

### Pathway 3: Local Millers
*Used by consumers of all income levels*
- ~ Weaker commercial opportunity compared to Pathway 1 but stronger than PDS

*Remaining considerations same as in case of rural consumption*

## 4 Farmer consumption

### Pathway 1: On-Farm Consumption
*Used by pearl millet farmers*
- ✓ Largest consumption channel
- × No commercial opportunity

We do not deep-dive into urban PDS as interventions for rural and urban PDS will be the same; Within the urban segment, private processors provide a potentially more impactful opportunity for GAIN and HarvestPlus to intervene

*The PDS pathway in the case of rural consumers can help achieve nutritional impact and scale, while private processors in the case of urban consumption can provide strong commercialization opportunities*

Source: Stakeholder consultations

1A

# Rural consumption, which accounts for 20% of the mkt, should rise as millet's recent inclusion in the PDS mainstreams (1/2)

| Current consumption by rural consumers (on average) | Potential addressable market |
|---|---|
| 20% of total pearl millet produced / 2 million tons annually | ~30-40% of rural households[1] |

*Overview*

**Millet inclusion in the PDS system is likely to drive pearl millet consumption among lower socio-economic classes**

- In 2018, the central government accepted the proposal to include the millet group of crops in the PDS system and as a result, allow distribution of pearl millet through the fair price shops at subsidized rates
- Wider availability at cheaper prices will increase consumption, allowing lower income groups to consume greater quantities
- Majority consumption will be from the future biofortified hybrid varieties as less than 15% produce comes from OPV produce
- District-level efforts in Andhra Pradesh demonstrated increased off-take of locally produced millets by households (when sold at subsidy), and a three time increase in production in target villages – this could indicate that pearl millet's inclusion in the PDS will increase the overall market rather than resulting in substitution of channels

**PDS inclusion of millet is underway and gaining momentum through policy development**

- NITI Aayog[2] is currently consulting stakeholders as it develops the PDS procurement policy, which is expected to come into effect by 2020 and be implemented initially through pilots in districts with high levels of both production and consumption
- Since the details are still to be worked out by the government, it is not yet possible to estimate the expected market increase

*Opportunities*

| Intervention area | Description | Importance |
|---|---|---|
| Support pearl millet inclusion in the PDS | • GAIN and HarvestPlus can potentially promote IPM adoption in districts identified by the government for piloting to maximize the interim impact<br>• Further, government can be supported with the implementation features of the PDS including procurement channels, procurement quantities, and sales channels | *High* |
| Explore inclusion of pearl millet in ICDS[3] and Mid-day Meal | • ICDS covers 70M mothers and children under 6 years, and Mid-day Meal covers 120M school children; inclusion in these programs can increase consumption significantly<br>• Odisha, as a part of its millet mission, is already pushing for finger millet consumption through its anganwadi centers and the mid-day meal scheme | *High* |

**INITIAL HYPOTHESES FOR DISCUSSION DURING DUBAI WORKSHOP**

Note(s): (1) Based on NSSO data - in 2009-10, 39% and 28% households reported consuming rice and wheat respectively through PDS; (2) Central government's policy think-tank; (3) Integrated Child Development Services, which focuses on children under 6, and their mothers
Source: NSSO, 'Public Distribution System and Other Sources of Household Consumption – 2010', 2013; LANSA, 'Review of Agri-Food Value Chain Interventions Aimed at Enhancing Consumption of Nutritious Food by the Poor: India', 2016; Stakeholder interviews

Dalberg

1B

# In the urban segment, affluent health-conscious consumers may be drawn to IPM's value proposition (1/2)

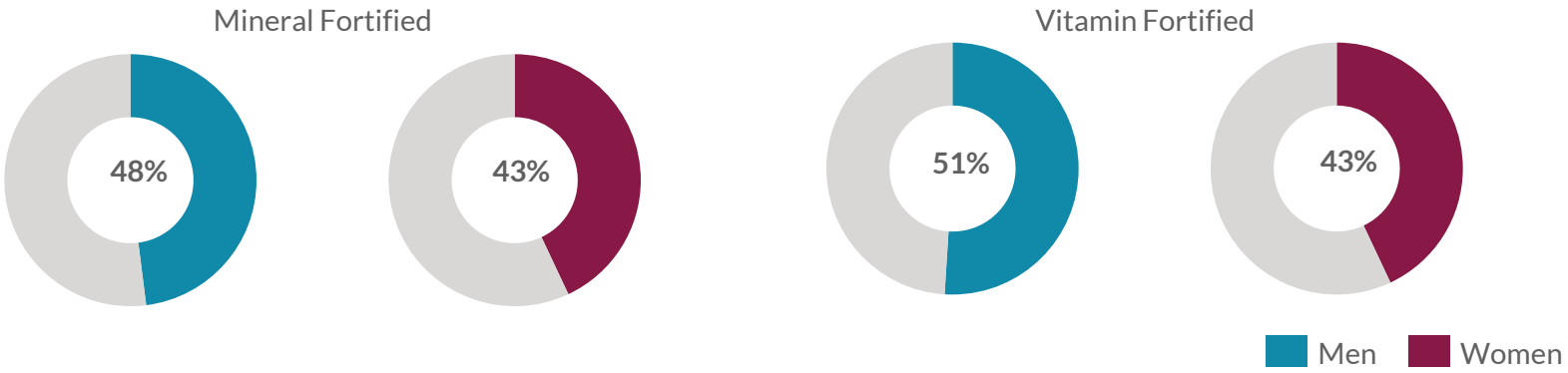
| Current consumption by urban consumers (on average) | Potential addressable market |
|---|---|
| 5% of total pearl millet produced / 0.5 million tons annually | ~90 M health conscious individuals through health foods market |

*Overview*

**The health foods market is a niche, booming market which targets the upper-middle and high-end urban consumers, and inclusion of pearl millet products in health foods can create an opportunity to increase their IPM consumption**

- 90 million health conscious individuals are present in India – the urban population is increasingly becoming health-conscious and looking for food alternatives to overcome their unhealthy lifestyle
- Processed or ready to eat products such as nutri-bars, breakfast cereals, multigrain bread are gaining popularity
- The healthy biscuits, breakfast cereals, and multigrain atta categories, categories relevant for pearl millet processed goods, have growth rates ranging from 5-10%, and are promising for manufacturers to enter
- Pearl millet offers a strong value proposition for this segment – pearl millet's nutritional benefits include high iron[1], protein, fiber etc. and marketing of such health claims by private can help drive demand for pearl millet products
- Pearl millet is also known to reduce cholesterol levels and minimize diabetes risk, a condition which prevails in 12-18% of Indian adults and especially in urban areas

**Percentage of Indian adults replying "very important" to the question "How important are the following health attributes in influence your purchase"[2]**




Note(s): (1) Unlike in case of some other biofortified grains, iron pearl millet contains sufficient iron content for processors to make health claims; (2) The survey did focus exclusively on urban consumers, but this trend is likely to be true or potentially even stronger in case of urban population
Source: Nielsen, 'India Acquires A Taste For Health And Wellness', 2019; FICCI, 'The changing landscape of the retail food service industry', 2018; Redseer, 'Indian Habit Of Being Healthy', 2018; Stakeholder consultations

1B

# In the urban segment, affluent health-conscious consumers may be drawn to IPM's value proposition (2/2)

**The private sector is actively pursuing the urban-health segment given its potential; adoption by food processors can provide a significant boost**

- The health and wellness foods segment, which targets consumers willing to pay premium prices for healthier food choices, is a USD 1.4 bn+ market and has a ~10% growth rate
- While some national level players such as ITC and Too Yum have included pearl millet as a raw material in their products, pearl millet has not become popular among urban consumers, like in case of quinoa or oats
- Pearl millet products are offered mostly by regional processors such as Bikaji, InnerBeing, etc. but are yet to achieve scale
- Further, key stakeholders such as IIMR and ITC[1] have also expressed interest in expanding pearl millet's product range

**Despite the potential, pearl millet's short shelf-life and under-developed value chains act as barriers; opportunity exists for HarvestPlus and GAIN to support large-scale adoption**

- Pearl millet flour less than 3 month shelf-life constrains its adoption in popular products like multigrain bread or 'atta' and the development of new product lines; some packaging solutions exist and on-going seed research by ICAR and Corteva CropScience is expected to provide a breakthrough in the next 8-12 months
- Under-developed supply value chains and lack of private sector experience in engaging with 'traditional' pearl millet farmers further act as constraints

*Opportunities*

| Intervention area | Description | Importance |
|---|---|---|
| **Partner with packaged foods companies** | • HarvestPlus and GAIN can work in tandem with the seed companies, farmers, and food processors, and support supply chain development through contract farming by acting as an honest intermediary<br>• Ensuring adoption by national level processors can help initiate momentum and nudge other major players to follow; further, interventions in product innovation to overcome coarse grain taste, build consumer awareness, and document evidence regarding bio-availability of nutrients can help drive adoption<br>• Further, penetrating the health foods market can have trickle down effects on the mainstream processed goods market and create a pathway to penetrate the larger urban consumer segment | *High* |

**INITIAL HYPOTHESES FOR DISCUSSION DURING DUBAI WORKSHOP**

Note: (1) While ITC was not consulted directly, multiple stakeholders have highlighted their name in this space
Source: NIELSEN, 'India Acquires A Taste For Health And Wellness', 2019; FICCI, 'The changing landscape of the retail food service industry', 2018; Redseer, 'Indian Habit Of Being Healthy', 2018; Stakeholder consultations; Dalberg analyses

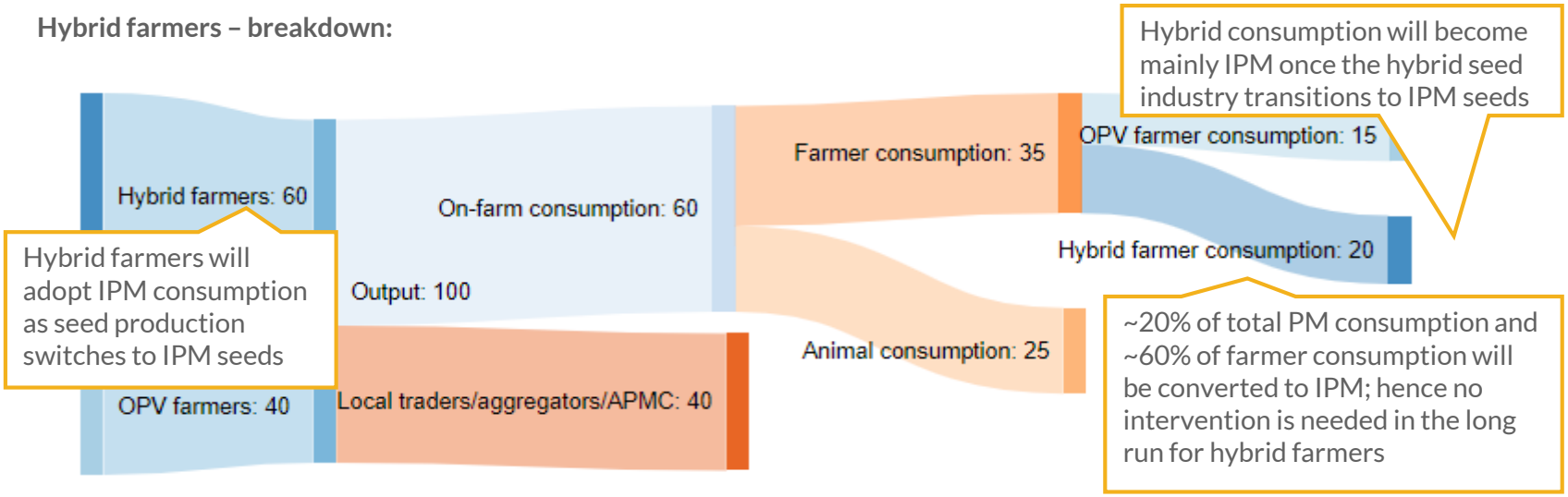
Dalberg

4

# Farmer consumption is the largest segment; most hybrid farmers are likely to convert to IPM without external intervention

| Current consumption by farmers (on average) | Potential addressable market |
|---|---|
| 35% of total pearl millet produced / 3.5 million tons annually | Over 20% of total pearl millet market (100% hybrid farmers) |

**Hybrid farmers – breakdown:**




**While OPV farmers have higher than average on-farm consumption, adoption of IPM by this segment may be less successful and even not essential in some cases**

- OPV farmers consume ~80% of their produce on-farm, a function of producing less overall than hybrid farmers and the large role pearl millet plays in their diet
- 75% of OPV farmers are located in Western Rajasthan, where the water availability is less than 400 MM, and switching consumption of such farmers - which can only be done by switching to hybrid seeds - may not be feasible
- Lastly, prima facie, higher pearl millet consumption, specially in case of Western Rajasthan farmers (who have particularly high levels of pearl millet consumption) could be sufficient to support their iron needs; although, this will need to be validated through scientific research

*No opportunity for high potential interventions may exist for on-farm consumption*

Note(s): (1) Assuming that on-farm consumption is split into 60% farmer consumption and 40% cattle feed
Source: Stakeholder consultations

Dalberg

# Policy

# The government's push for nutri-cereals, including pearl millet, has led to a strong policy environment across the value chain

Enabler Potential opportunity Barrier

| | Pre-farm | On farm | Post farm value chain | Consumption |
|---|---|---|---|---|
| | • The Government of India launched the National Millet Mission in 2018 to promote nutri-cereals (pearl millet included)<br>  • Media reports cite the government's expected outlay to be ~INR 800 cores for the next 2 years<br>  • Initiatives include setting up seed hubs in millet growing states, supporting farmers with technical inputs, and on farm-gate processing, aggregation, and linkages to value addition in industry and market<br>• India celebrated 2018 as the year of millets; Further, 2023 has been announced as the international millet mission by the FAO on Indian government's recommendation | | | |
| National | • ICAR in 2018 released a guideline mandating 42 PPM iron content as a threshold for its approval<br>• ICAR approval necessary for seed's inclusion in government agriculture programs, and therefore compliance is likely to be high even though it is not mandatory | | • MSP price per quintal for Pearl millet has increased from INR 1425 in 2017-18 to INR 2000 in 2019-20<br>• As a result, return on cost has become 85%, highest amongst the kharif crops category<br>• Nutrihub by IIMR providing technical support to agri-preneurs for creation of millet processed products | • Government allows millets inclusion in PDS in 2018; procurement policy being developed currently<br>• Pearl millet production likely to rise; greater increase expected from higher output by OPV farmers as they switch to hybrids compared to farmers increasing production area<br>• Millet inclusion in ICDS and Mid-day meal yet to be taken up |
| State | • State approvals, necessary for sale, do not require ICAR compliance; but above-mentioned incentives help overcome this barrier | • Odisha Millet Mission launched with an outlay of INR 100 crores; major focus is on finger millet | | |

A strong push through central government initiatives will likely drive pearl millet production and consumption

Source: Tripathi, Amarnath & Mishra, Ashok.. "The Wheat Sector in India: Production, Policies and Food Security." 2017.; Government of India, "Guidelines for Establishment of Nutri-farms Scheme", 2014.; PIB, 'A Government that cares for its Farmers', 2019; BusinessLine, 'Millet Mission to promote nutrient-rich cereals; ₹800-crore outlay on the cards', 2018; Stakeholder consultations; Dalberg analyses

Dalberg

# Annex

# **Policy Landscape:** Food fortification in India began in the 1950s; progress has been slow

**1950-99 — FIRST FORAYS INTO FOOD FORTIFICATION IN INDIA**

- **1953** — GoI mandates fortification of Vanaspati with Vitamin A
- **1962** — GoI bans sale of non-iodised edible salt in goitre-endemic regions under National Goitre Control Programme
- **1997** — GoI bans sale of non-iodised edible salt across country under Prevention of Food Adulteration Act 1954, which is **de facto mandatory iodization of salt**

**2000-15 — FRAGMENTED REGIONAL PILOTS and GOV SCHEME-SPECIFIC INITIATIVES**

- **2000** — West Bengal initiates first pilot for wheat flour fortification in Darjeeling district
- **2004** — Double Fortified Salt is produced by Tamil Nadu Salt Corporation and introduced in state's MDM scheme. DFS is now available in all districts of TN through PDS, MDM and ICDS
- **2006** — Government of Gujarat mandates fortification of edible oil
- **2008** — Cargill India Pvt. Ltd. is first provider to fortify edible oil in India
- **2010** — PATH implements first pilot for rice fortification in India through Andhra Pradesh MDM scheme. But since then, only 2-3 districts in AP implementing in their programmes
- **2011** — GAIN helps pilot edible oil fortification in Rajasthan, where Fortified Edible Oil is now available in all districts through PDS, MDM and ICDS
- **Jun-Jul 2011** — MoWCD and MoHRD issue directives mandating DFS in ICDS and MDM schemes
- **2014** — Higher quality pre-mix for DFS developed using encapsulated Ferrous Fumarate
- **2015** — Tata Salt Plus is launched as India's first national brand of packaged DFS

***This period also witnessed some policy missteps:*** *In 2000, GoI lifted ban on non-iodised edible salt post-backlash from industry, but re-introduced ban in 2005/6 when 50% HH already consuming*

*Nearly **60 years gap** between global introduction of **rice and wheat fortification** and first pilots of Fortified Rice and Wheat in India*

Oil · Salt · Rice · Wheat · Key cross-cutting events

Notes: GoI: Govt. of India; MDM: Mid-day Meal; DFS: Double Fortified Salt; TN: Tamil Nadu; PDS: Public Distribution System; ICDS: Integrated Child Development Services; MoWCD: Min. of Women and Children Development; MoHRD: Min of Human Resource Development
Source: FSSAI, Large Scale Food Fortification (Oct 2017); FFRC, Brochure (May 2019); Expert Interviews, Dalberg Research

# **Policy Landscape:** Momentum has increased nationally only in the last 3 years owing to FSSAI advocacy and the set-up of FFRC; however, FF still lacks a unified policy framework

**2016-Current** | **FOOD FORTIFICATION ENTERS THE NATIONAL AGENDA**

| | |
|---|---|
| 2016 | FSSAI lays down standards for fortification of all staples, the F+ logo is introduced |
| Dec 2016 | MoCA,F&PD issues circular directing states to only use Fortified Wheat Flour in their PDS schemes |
| 2016 | General Mills is first provider to fortify wheat flour in India |
| 2017 | DCP Foods Pvt. Ltd. launches "Asbah" Fortified Rice in open market |
| Jul-Aug17 | MoWCD and MoHRD extend mandate use Fortified Edible Oil and Fortified Wheat Flour in ICDS and MDM |
| Mar 2018 | The Prime Minister's Office launches the National Nutrition Mission (NNM), or "Poshan Abhiyaan," which cites food fortification as an intervention to address malnutrition in India. However, little focus on FF within NNM, indicating **FF still lacks a comprehensive national policy framework** |
| Aug 2018 | FSSAI sets up Food Fortification Resource Center (FFRC) with financial assistance from Tata Trusts |
| Aug 2018 | Food Safety and Standards Regulations for fortified staples are notified in the Gazette of India |
| Oct 2018 | MoCA,F&PD issues an advisory urging states to publicize the benefits of Fortified Edible Oil |
| Feb 2019 | MoWCD issues an order mandating use of Fortified Rice in ICDS and SABLA schemes |
| Mar 2019 | The GoI announces a pilot for the distribution of Fortified Rice in 15 districts across India (15 states x 1 district) for 3 years through the PDS |

***India moved from fragmented pilots to key national policies only in the last 3 years due to:***

- ***Limited government consensus*** *and* ***political will*** *to drive fortification agenda forward*
- *Contention between policymakers/ activists as to whether food fortification ought to be* ***mandatory or voluntary****. This debate persists even today.*

***Rice fortification*** *entered the national policy landscape only in 2019,* ***much later*** *than the fortification of other key commodities.*

Oil | Salt | Rice | Wheat | Key cross-cutting events

Biofortification (BFF) is yet to achieve attention similar to food fortification at the national stage; while government has been discussing the idea, a policy or framework is yet to be materialize

Notes: FSSAI: Food Safety and Standards Authority of India; MoCA,F&PD: Ministry of Consumer Affairs, Food and Public Distribution Department of Food & PD; FF: Food Fortification;
Source: Large Scale Food Fortification (Oct 2017); Expert Interviews; Down To Earth, Making Food Fortification Mandatory is Illegal (2018), Dalberg Research

# **Field research** We conducted interviews with ten stakeholders

| | | | | Topics covered | | | | |
|---|---|---|---|---|---|---|---|---|
| # | Org. Name | Org type | Expert Name | Pre-farm | On farm | Post farm VC | Consump-tion | Policy & financing |
| 1 | National Institute of Nutrition (NIN) | Public sector | Dr. Sesikeran | ✓ | | | | |
| 2 | National Institute of Nutrition (NIN) | Public sector | Dr. Radhika Madhari | | | | | |
| 3 | PCI Global | Civil Society | Basanta Kumar Kar | | | | | ✓ |
| 4 | All India Food Processors Association | Industry organization | Satansh Kumar | | | ✓ | ✓ | |
| 5 | Bayer Crop Science | Private sector | Jayalekha AK | ✓ | ✓ | | | ✓ |
| 6 | Indian Council for Agriculture Research (ICAR) – AICRP | Public sector | Dr. C Tara Satyavati | ✓ | ✓ | ✓ | | ✓ |
| 7 | Indian Institute of Millet Research | Public sector | Dr. Dayako Rao | | | ✓ | ✓ | |
| 8 | Karnataka State Seed Corporation | Public sector | Dr. Sangam | ✓ | | | | |
| 9 | Rigdam Snacks | Private processor | Madhavi Pomar | | | ✓ | | |
| 10 | Seed works | Private sector | Dr. RS Mahala | ✓ | | | | |

# We have conducted a rapid scan of tech-enabled farmer solutions that can be considered for driving interventions (1/2)

NON-EXHAUSTIVE

| Platform Name | Description |
|---|---|
| Digital Farmers | • A mobile application that connects different agriculture ecosystem actors and supports with knowledge dissemination<br>• Farmers, input dealers, merchants etc. can connect with each other using the app<br>• Information on government schemes for farmers, ogranic farming practices, latest market prices etc., and optimal farming practices are shared using the app<br>• SMS as well as call center services are used to communicate with farmers |
| BigHaat | • An online digital platforms for farmers to purchase quality inputs such as seeds, fertilizers, pesticides, nutrition supplements, farm machinery from a variety of brands<br>• It also provides doorstep delivery facilities as well as knowledge services through the website and call services |
| Ekutir | • A one-stop-shop that offers an online and mobile-based platform to connect marginal farmers with stakeholders across the value chain such as soil-testing labs, suppliers of seeds and fertilizers, banks, exporters, food-processing units, and branded retailers<br>• Field partners also train farmers to use their application |
| Blooom | • An integrated soil-to-shelf digital platform for smallholder farmers that supports sustainable food supply value chains<br>• Services include access to information, finance, sustainable inputs, agri services, and markets |
| ITC E-Choupal | • An assisted platform that has village internet kiosks managed by farmers - called sanchalaks<br>• Kiosks support the agriculture community with:<br>  ○ access-ready information in their local language on the weather & market price<br>  ○ knowledge on scientific farm practices & risk management<br>  ○ sale of farm inputs, and<br>  ○ purchase of farm produce from the farmers' doorsteps |

Source: Organization websites

# We have conducted a rapid scan of tech-enabled farmer solutions that can be considered for driving interventions (2/2)

NON-EXHAUSTIVE

| Platform Name | Description |
|---|---|
| Kisan Network | • A tech-enabled supply chain platform for farmers in India<br>• It enables small and marginal farmers to sell their fresh produce directly to businesses across the country, using their smartphone<br>• It takes cares of the complete PAN-India supply chain from the farm directly to the buyer's doorstep |
| KrishiYog | • KrishiYog is a platform that supports farmers with multiple touchpoints such as productivity improvement, market linkages, and finance<br>• It has the extension service platform to support farmers with production practices<br>• It also has the ERP platform that helps farmer producer companies and farmer cooperatives to manage their operations<br>• KrishiYog has a credit rating platform to support NBFCs and banks assess credibility of the borrower and lend at optimal interest |
| Ergos | • Ergos provides warehousing solutions to farmers as well as food processing units by acting as an intermediary for storing the produce<br>• The farmers can sell the produce to Ergos at the local micro warehouses, where the quality and quantity is checked and approved before sale of the produce<br>• Based on the quality and quantity data, prices are negotiated with food processing companies<br>• Food processing companies can then buy the produce through Ergos, helping them save on the brick and mortar costs of warehouses<br>• The entire model is supported using technology platform, which includes a mobile app for the farmers to connect with Ergos, and the tech platform for monitoring the entire operations |

Source: Organization websites

# **Financing:** All levels of the Indian government actively finance the agriculture industry across the supply chain

TO BE DEVELOPED FURTHER POST-DUBAI

| | Pre-farm | On farm | Post farm value chain | Consumption |
|---|---|---|---|---|
| National | • National Bank for Agriculture and Rural Development (NABARD) serves as a refinancer to other banks and provides financial assistance with a focus on rural communities | • PMFBY provides crop insurance if farmers pay 2% premium for *kharif* crops and 1.5% for *rabi* crops (5% for annual commercial crops) | • Trader credit helps middlemen traders make transactions on a wholesale scale | • Agriculture is designated as a priority sector for banks to reach a target coverage in lending. In 2011, banks exceeded the Rs. 37.5 million target by over 20% |
| State | • State Cooperative Banks (SCBs) primarily provide short and medium-term agricultural credit | • NFSM allocates Rs.15000 per cluster for all crops for food processing and value addition in products. | • Initiative for Nutritional Security through Intensive Millets Promotion (INSIMP) established 300 post-harvesting unites to supply raw materials for value-added products | • Regional Rural Banks (RRBs) mostly mobilize financial resources for small farmers, but also other agricultural laborers |
| Local | • NFSM allocates Rs 200 crores for establishing nutri-farms in districts most affected by malnutrition | • NFSM offers Rs.2 lakh per district to review meetings and monitor implementation | • NFSM provides Rs.15000 per district for food processing and value addition of bio-fortified crops | • NFSM provides Rs.1.00 lakh per district for media purposes to raise awareness for consumption of nutri-rich products |

Source: Government of India, "Guidelines for Establishment of Nutri-farms Scheme", 2014.; Kumar, Raj, "Workshop on Enhancing Exports' Competitiveness Through Value Chain Finance", 2012.