# FP-05: Post-rainy season sorghum consumption in Maharashtra and opportunities for demand enhancement

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## Abstract

*For majority of the households living across Semi-Arid Tropics (SAT) of India sorghum is an important staple in the consumption basket of households besides providing feed and income security. By and large sorghum and particularly post rainy season sorghum is grown as subsistence crop under low yield regimes. Hence, to address the issue of low yields a project on Harnessing Opportunities for Productivity Enhancement (HOPE) is envisioned to improve productivity of post rainy season sorghum and associated factors of technology adoption and improve market access by International Crops Research Institute Semi-Arid Tropics (ICRISAT) and its partners. Improving market access requires careful understanding of consumer choices, end-user preferences, processing options to improve product quality and reduce household food processing time. In this context a detailed survey on sorghum consumption, its demand for various uses, consumer preferences, perception and price and non-price factors that determine the demand for sorghum in human diets is carried out in Maharashtra, (Western and Marathwada regions) of India, which is predominantly sorghum growing and consuming region. Evidence from the study indicates that post rainy season sorghum is a staple for consumption irrespective of household income but urban consumers are less frequent consumers as compared to their rural counterparts. Though urban households perceive the importance of consumption of nutrient rich millets like sorghum, lack of time for cooking sorghum bread as both men and women are employed in urban locations; skill sets required for preparation; easy availability of diversified ready to eat products from rice and wheat; non-availability of diversified ready to eat products of sorghum have contributed to decline in its consumption. Value addition (grading and cleaning) and development of diversified ready to use value added products of sorghum (flour, rawa, flakes etc) are found to stimulate consumption demand. Sale of cleaned sorghum grain in small packs is desired by many urban consumers. Unlike barley, finger millet and maize, private sector participation for development of value added products in sorghum is low. Hence, development of diversified ready to use products with private sector participation will enable in enhancing the demand for sorghum, product choice and nutriceutical benefits for consumers and improve market access to farmers.*

**Key words:** Post-rainy season sorghum, Sorghum consumption, Value addition

Sorghum is an important staple in the consumption basket of households across Semi-Arid Tropics (SAT) regions of India. Besides grain, stover of sorghum is an important source of feed for livestock particularly in the dry seasons when other feed resources are in short supply. Sorghum in India is grown in both the rainy and post–rainy season. For majority of the households dependent on post rainy sorghum for living, subsistence farming system still predominates. In the recent years, major new trends towards increasing demand for sorghum have also begun to emerge that provide a renewed opportunity for sorghum in the market

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place. Though large productivity gains are biologically possible under semi-arid conditions, the yields of post-rainy sorghum are still hovering around 0.5 to 0.7 metric ton of grain per hectare. Translating these benefits for the poor require significant and targeted pro-poor efforts.

Hence to provide poor dryland households with the technologies, linkages and development impetus a project "Harnessing Opportunities for Productivity Enhancement" (HOPE) funded by Bill and Melinda Gates Foundation (BMGF) is being implemented in an integrated value chain approach in selected target areas representative of major sorghum production zones (Western and Marathwada regions of Maharashtra) by International Crops Research Institute for the Semi-Arid Tropics (ICRISAT). The overall vision of the project is to increase sorghum yields for targeted farmers by 35-40% through improved cultivars and associated management practices, with adoption enabled and motivated through the development of markets and value chains, from input supplies to output markets. Associated with the factors of technology adoption and market access is generation of knowledge on sorghum consumption, their pattern and factors influencing which stimulate market demand.

Investigating opportunities for dryland cereals, new marketing approaches that reduce transaction costs, investment in market institutions, value chains, processing methods and innovations and better provision of market information are expected to increase trade and stimulate consumer demand. But this would require careful understanding of consumer choices, end-user preferences, processing options to improve product quality and reduce household food processing time. Hence, it is in this context a detailed survey on sorghum consumption, its demand for various uses, consumer preferences, perceptions and price and non-price factors that determine the demand for sorghum in human diets is carried out. The focus of this study is primarily on post-rainy sorghum. The data collected from the survey is analysed and the results are discussed in this paper.

## Materials and Methods

The data source for this study is the primary survey on sorghum consumption carried out in HOPE clusters of Western and Marathwada regions of Maharashtra namely; Ahmednagar, Solapur and Pune of Western region and Jalna, Beed and Parbhani districts in Marathwada region. As most of the households from villages of HOPE clusters consumed sorghum, households are selected randomly for the survey from HOPE villages. To compare and contrast the consumption of sorghum between rural and urban households, data on consumption is collected both from urban and rural locations of these districts. Location (area of residence) as a criterion is employed to select the samples representing different income strata in urban areas while landholding size is used as a criterion for rural areas.

A sample of 360 households are selected to understand the household sorghum consumption patterns in HOPE clusters. Of the 360 households, 180 samples each are from the regions of Western and Marathwada Maharashtra. To give adequate representation between urban and rural households 50% of the households are selected from rural areas and the remaining 50% are from urban areas. Additionally, a sample of 23 households from Aurangabad[1] district of Maharashtra are also surveyed to understand sorghum consumption patterns. The household surveys are conducted through structured questionnaire consisting information pertaining to demographics, consumption of cereals and sorghum, frequency and attribute preferences of sorghum consumption and constraints and suggestions to enhance demand. The survey is carried out during 2011 and the results of the survey are summarized in this report.

To capture the sorghum consumption pattern across households of HOPE clusters, sample households are segmented based on income and the data is analysed for the income deciles and quartiles. To understand the factors influencing

sorghum consumption a model of the form; $Y_i = \beta_0 + \beta'_i X_i + \varepsilon_i$ is employed and regression analysis is carried out using ordinary least squares technique. Sorghum consumption (dependent variable) is regressed against the independent variables income (Rupees); household sorghum production (kilograms); household size (number); age; occupation dummy (business/salaried/labor); location dummy (rural/urban); and education (years of schooling). Ranking technique is employed to understand the attribute preferences of sorghum for consumption, constraints affecting consumption and suggestions to enhance demand.

## Results and Discussion

*Household demographics*

The average household size is the highest at 7 in rural areas of Marthwada region with average child to adult ratio at 0.4. The average household size in urban regions of both western and marathwada regions is 5 (Table 1). The average annual income of the sample household of HOPE clusters is the highest in western Maharashtra at Rs.3, 08, 611.

Salaried employment and business are the major source of income of the sample households in urban localities of Western Maharashtra. In rural localities of Marathwada and Western Maharashtra agriculture is the primary source of occupation (Table 2) and is the major source of income.

*Sorghum share in cereal consumption*

Across cereals, the average annual consumption of sorghum has been the highest both in rural and urban areas of western Maharashtra and Marathwada region. On an average, households consume 248 and 343 kgs annually in rural areas of Western and Marathwada regions of Maharashtra respectively (Table 3). Unlike in rural areas, in urban areas wheat has the highest share of consumption among cereals in both Western and Marathwada regions of the state. Rice is the least preferred for consumption among the sample households in both regions as also in both rural and urban areas.

Across the two regions of HOPE clusters, Marathwada region has higher consumption of sorghum compared to Western Maharashtra both in rural and urban areas. Jalna, Beed, Aurangabad and Parbhani districts of Marathwada region have the highest share of sorghum cultivation in Maharashtra. These districts are prone to erratic rainfall with infertile and fragile soils. Here both rainy and post-rainy season sorghum that are tolerant to drought and erratic rainfall etc are cultivated and forms one of the main staples for food and feed security. Though the consumption of sorghum is higher in Marathwada region, the share of post-rainy season cultivation is low relative to Western region (63% in Western Maharashtra while it is only 21% in Marathwada Maharashtra (GOI 2009). Thus besides local production, post-rainy season sorghum is also imported from western region to meet the consumption demand of the Marathwada region.

*Per capita monthly consumption of sorghum- a comparison between HOPE and NSSO surveys*

National Sample Survey Organization (NSSO), the most established data collection organization in India carries out various surveys and studies across sectors (agriculture, industry, employment etc) every year for planning, policy formulation, decision support and inputs for further statistical analysis. NSS surveys on household consumption expenditure with large sample size are carried out quinquennially (NSSO, 2010). A comparison is made with the survey findings from HOPE clusters on sorghum consumption with NSS surveys to capture similarities / dissimilarities between the two.

*Sorghum consumption- A decile analysis*

NSS captures the data on expenditure for all the items consumed by the households in its surveys and reports consumption based on monthly consumer expenditure of the households. In the current study, since the purpose is to understand the consumption pattern of sorghum and other cereals consumed by the households, such an exhaustive data on consumption expenditure for all commodities is not captured. Hence the analysis is carried out based on annual income reported by the households. Consumption patterns have wide variations

**Table 1. Sample household characteristics under HOPE clusters of Maharashtra**

| Region | Household type | Average household size (Number) | Average child to adult ratio | Average annual income (Rs) |
|---|---|---|---|---|
| Western Maharashtra | Rural | 6 | 0.3 | 154, 472 |
| | Urban | 5 | 0.4 | 308, 611 |
| Marathwada Maharashtra | Rural | 7 | 0.4 | 160, 549 |
| | Urban | 5 | 0. 2 | 164, 495 |

**Table 2. Occupation of sample household in HOPE clusters of Maharashtra**

| Occupation | Western | | Marathwada | |
|---|---|---|---|---|
| | Urban | Rural | Urban | Rural |
| Farming | 6 | 60 | 7 | 65 |
| Employee | 40 | 4 | 48 | 11 |
| Business | 26 | 3 | 18 | 5 |
| Labor | 17 | 21 | 23 | 20 |
| Others | 1 | 1 | 5 | 1 |
| Total | 90 | 89 | 101 | 102 |

**Table 3. Cereals consumption pattern of households in HOPE clusters of Maharashtra (Kgs)**

| Average annual consumption | Western | | Marathwada | |
|---|---|---|---|---|
| | Rural | Urban | Rural | Urban |
| Sorghum | 248 | 131 | 343 | 177 |
| Wheat | 226 | 178 | 250 | 237 |
| Rice | 78 | 86 | 82 | 75 |

across locations, income groups, age and various other factors. Income level of households is found to be a significant factor contributing to variations in consumption. To get an understanding of the importance and variations in consumption of sorghum across income groups, a decile level analysis is carried out for both the regions. In Western region the bottom 6 deciles have higher consumption as compared to the top 4 deciles whereas in Marathwada the bottom decile has the maximum consumption of sorghum at 52 kgs (Table 4 and Figure 1). Marathwada region has higher consumption of sorghum (range of 30-50%) in comparison to Western region across all deciles except for the 5th and 6th decile groups. The higher consumption of sorghum by the bottom deciles shows the dependency and importance of sorghum in the consumption basket of the poor households.

Sorghum consumption- a quartile analysis

The decile level consumption analysis could not be segregated based on rural and urban population due to inadequacy in sample size for such an analysis. Hence, to get better insights on consumption based on the population type (rural/urban), analysis is carried out based on income quartiles.

The data aggregated based on population type for different quartiles has shown findings which could not be captured at decile level. The decile level analysis showed only the importance of sorghum consumption for the bottom three deciles.

The aggregated data shows that in rural areas of both Western Maharashtra and Marathwada regions sorghum consumption is important for all the 4 quartiles (Table 5). The preference and importance of sorghum consumption in urban areas is reflected in higher quantity of consumption by the bottom two quartiles more specifically in the Western region. In urban areas of Marathwada region, the spread is less evident between quartile which again goes to show the importance of sorghum consumption even in urban areas. Thus, the inverse relation between income and sorghum consumption is evident only for the top two quartiles of the urban population.

One other significant finding is that the top most quartile in rural areas has higher consumption of sorghum compared to the bottom quartile by about 8-9%. The result shows that access to income (purchasing power) is also an important factor for sorghum consumption in rural areas.

*Consumption of sorghum- Frequency and seasonality in consumption pattern*

For majority of the sample households in HOPE clusters, sorghum forms the major staple food for consumption and is almost consumed daily. The frequency of daily consumption is more prominent in rural areas as compared to urban areas. In rural areas of both western and marathwada regions, more than 85% of the households consume sorghum daily while in urban areas more than 80% of the households consume wheat (Table 6). One of the main reasons for daily consumption of sorghum in rural areas could be due to farming which is the major occupation that is strenuous and households prefer sorghum in their diet as it provides more energy compared to other cereals; secondly, though preparation of sorghum bread is time consuming, for rural households time is not a constraint. In urban areas, rice and wheat are preferred because of time constraint for cooking sorghum and ease of preparation of diversified products from rice and wheat. Additionally, sorghum products particularly *roties* (flat breads) requires experience and special skills for preparation which discourages several urban households from including sorghum in their daily diets. This is corroborated by the finding from the survey that only about 6% of the households in urban areas of Western Maharashtra consume sorghum weekly or occasionally. The region of Western Maharashtra comprises districts of Pune and Ahmednagar which are highly urbanized and are cosmopolitan.

**Table 4. Decile-wise average annual per capita consumption sorghum consumption in Maharashtra**

| Decile | Western Maharashtra | Marathwada Maharashtra |
|---|---|---|
| | Average annual per capita sorghum consumption (Kgs) | Average annual per capita sorghum consumption (Kgs) |
| 1 | 16 | 47 |
| 2 | 23 | 48 |
| 3 | 39 | 53 |
| 4 | 19 | 43 |
| 5 | 43 | 37 |
| 6 | 45 | 37 |
| 7 | 34 | 51 |
| 8 | 42 | 49 |
| 9 | 34 | 43 |
| 10 | 39 | 52 |

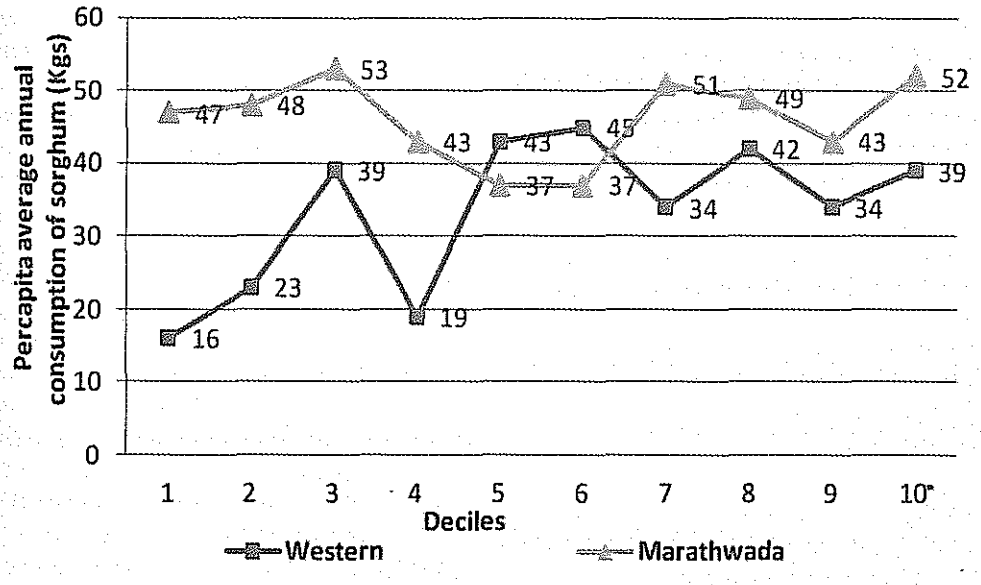


**Fig 1.** Consumption pattern of sorghum.

With both men and women employed in majority of the households there is lack of time for cooking. Though the consumers perceive the benefits of consumption of sorghum, fast food and easy to cook food items become the preferred choice of consumption. Hence, for better penetration of sorghum in the food consumption basket of urban households, value addition and development of value added products holds the key as a strategy to increase the consumption and market demand of for sorghum based products.

As indicated earlier the temperatures are extremely harsh in these regions of Maharashtra. Sorghum consumption during summer months is perceived to keep the body cool (anecdotal evidence from households of HOPE clusters). The perception is further corroborated from the findings on seasonal consumption pattern as evidenced in Table 7. The perceived benefits of sorghum consumption during summer is evidenced both in urban and rural areas of HOPE clusters. On an average sorghum consumption is high by 1-1.5 kg during summer months as against rainy season. There is a marginal difference in consumption during rainy and winter season. Post-rainy season sorghum which is mainly used for food consumption is harvested during the months of March to April and the freshly harvested produce is available immediately which coincides with summer months. As

**Table 5. Quartile-wise per capita average annual sorghum consumption (kgs)**

| Quartile | Rural | | Urban | |
|---|---|---|---|---|
| | Western | Marathwada | Western | Marathwada |
| 1 | 39 | 58 | 17 | 39 |
| 2 | 46 | 56 | 19 | 28 |
| 3 | 46 | 51 | 23 | 37 |
| 4 | 36 | 53 | 38 | 41 |

the preference is high during summer, to further enhance the consumption demand specifically in urban areas value added products of sorghum like for example, flakes, cakes, biscuits, ready to eat and drink products of sorghum can be promoted which caters to urban demand.

*Factors influencing sorghum consumption and consumer preferences*

Regression analysis by employing the technique ordinary least squares is carried out to understand the factors influencing the consumption of sorghum. Table (8) presents the findings of the regression analysis.

The coefficient of income is close to zero and significant in both the regions. This indicates that the effect of income is negligible or inelastic on sorghum consumption of households which is a staple for consumption in the regions. The coefficient of household size is significant and positive in both the regions which indicate higher sorghum consumption in larger households. Coefficients of occupation dummy (business and salaried) are significant and negative at 10% level. This suggests that households with occupation as business and white collar employment (salary) consume less of sorghum as their energy requirements are low compared to those practicing farming. The findings from regression coefficients of occupation dummies also corroborate the earlier findings and interpretation on frequency of sorghum consumption by households with farming as the major occupation. Effect of education on household sorghum consumption is negative in both the regions but is found to be significant only in Marathwada region. This suggests that though more number of years of education create awareness, this has enabled especially the urban households to diversify their diets towards easy to cook cereals like wheat and rice. As expected the coefficient of location dummy is significant for Marathwada region indicating rural households consume more sorghum compared to their counterparts in urban locations. The reasons for such observations have already been discussed in the earlier sections.

*Quality attributes of sorghum consumption and their perceptions*

*Purchase habits*

In majority of the rural households, sorghum consumption is from household production. Hence, across both the regions of western Maharashtra and Marathwada region the %age share of frequency of buying sorghum under "never" category is high by 62% and 65% respectively across rural households (Table 9). Across categories of frequency of buying sorghum, yearly purchase of sorghum is highest (32% and 34%) in urban households of both

**Table 6. Consumption frequency of sorghum in rural and urban areas of HOPE clusters**

| Frequency of consumption | Area | Western | | | Marathwada | | |
|---|---|---|---|---|---|---|---|
| | | Sorghum | Wheat | Rice | Sorghum | Wheat | Rice |
| Daily | Rural | 99 | 81 | 37 | 88 | 63 | 35 |
| | Urban | 66 | 83 | 73 | 69 | 88 | 53 |
| Once in 2-3 days | Rural | 1 | 17 | 40 | 8 | 21 | 27 |
| | Urban | 18 | 9 | 16 | 24 | 10 | 32 |
| Weekly | Rural | 0 | 0 | 11 | 2 | 10 | 24 |
| | Urban | 7 | 1 | 1 | 5 | 1 | 12 |
| Occasionally | Rural | 0 | 2 | 11 | 1 | 7 | 13 |
| | Urban | 6 | 6 | 8 | 0 | 0 | 3 |
| Never | Rural | 0 | 0 | 0 | 1 | 0 | 1 |
| | Urban | 3 | 0 | 1 | 1 | 1 | 0 |

the regions. Generally, for most of the households consumption of staple cereals is almost fixed and in many cases the annual requirement is known and hence households prefer buying sorghum on yearly basis rather weekly or monthly.

To understand what quality attributes of sorghum determine the price the consumer is willing to pay, consumers are asked to rank the quality attributes for grain, flour and processed product. Since, visible attributes determine the quality for grain and invisible attributes for flour, the quality attributes are categorized as visible and invisible. The visible attributes for grain are size of grain (big/small), color of grain and cleanliness while it is keeping quality, elasticity of dough, taste and ease of preparation are the invisible attributes ranked by the consumers.

Bigger size of the grain is ranked as the highest quality attribute preferred by consumers across regions and localities except in rural households of western Maharashtra followed by color (Table 10). Among invisible attributes, keeping quality of flour is ranked highest 37%, 40%, 37% and 43% across rural and urban household of Western and Marthwada region respectively (Table 11). Keeping quality of flour has been one of the major constraints for enhancing the demand for sorghum. Hence, most of the consumers have expressed willingness to pay for sorghum flour which has better keeping quality. Taste as an attribute which is invisible but perceived by consumers is the next highest ranked attribute preferred by the consumers while elasticity of dough and ease of preparation are the other factors preferred by consumers especially in urban localities of Western Maharashtra.

*Perceptions about sorghum consumption*

The perception of sorghum consumption is captured both from factors influencing and factors constraining consumption.

*Factors influencing sorghum consumption*

As has been said earlier, one of the major factors listed by consumers for sorghum consumption is because of it being a staple food in the consumption basket. On an average 52% and 59% of rural households in western Maharashtra and Marathwada region respectively agreed that sorghum is a staple food. The other major factors listed by the consumers are related to health consciousness and sorghum being less expensive compared to other cereals. Interestingly, on an average about 60% of the sample households in urban localities of Western Maharashtra consume sorghum as they are health conscious (Table 12). Owing to surge in medical problems such as diabetes and coronary heart diseases consumer's awareness toward health is increasing. The empirical findings on health as a factor for consumption of sorghum provide opportunities for the processing industry for the development of value added products. The products developed from sorghum (for example low calorie high nutrient flakes, energy biscuits and other value added products) can be promoted as health food to cater to the demand

**Table 7. Seasonal consumption pattern of sorghum (kgs)**

| Consumption | Western | | Marathwada | |
|---|---|---|---|---|
| | Rural | Urban | Rural | Urban |
| Summer | 3.97 | 2.59 | 4. 28 | 2.97 |
| Rainy | 2.63 | 1.33 | 4. 16 | 2.78 |
| Winter | 3.46 | 1.98 | 3.68 | 2. 28 |

**Table 8. Determinants of household consumption of sorghum in HOPE clusters**

| Variable | Western | | Marathwada | |
|---|---|---|---|---|
| | Coefficient | 't' value | Coefficient | 't' value |
| Household sorghum production | 1.04 (0.80) | 1. 29 | 3.74 (1.37) | 2.74* |
| Income | 0.00** | -2. 17 | 0.00** | 2. 15 |
| Household size | 24.56* (2.43) | 10.09 | 25.03* (4.87) | 5. 14 |
| Age | -0.69 (0.59) | -1. 18 | | |
| Education | -0. 20 (1.56) | -0. 13 | -7.38* (2.73) | -2.7 |
| Location- Rural dummy (default urban) | 27.41 (20. 18) | 1.36 | 64.77** (26.64) | 2.43 |
| Occupation – Business dummy | -76. 26* (25.97) | -2.94 | -100.45* (38.89) | -2.58 |
| Occupation – Salaried dummy | -89. 27* (26.52) | -3.37 | -65.58** (33.48) | -1.96 |
| Occupation – Labor dummy | -25.41 (23.92) | -1.06 | 7.92 (33.33) | 0. 24 |
| Constant | 120.40 (43.77) | 2.75 | 123. 29 (49.61) | 0.014 |
| R2 | 0.58 | | 0.44 | |
| Prob > F | 0.00 | | 0.00 | |
| Number of observations | 179 | | 191 | |

*Note:Figure in parentheses indicate standard error.*Significant at 5% level and ** significant at 10% level.*

of health conscious urban consumers and enhance the consumption demand. This type of penetration of value added products specifically targeting urban consumers have been very successful in case of low value high calorie cereals like barley, finger millet and maize in India.

*Factors constraining sorghum consumption*

Availability of subsidized rice and wheat through public distribution has been one of the major factor for decline in consumption of majority of the coarse cereals as also sorghum (Parthasarathy Rao *et al.* 2010). On an average 89% of the sample respondents from rural localities of Marathwada region opined this to be the constraining factor (Table 13). The recent policy decision of Government of India of supplying millets (sorghum, pearl millet and finger millet) at a cheaper price compared to rice and wheat is a welcome move in the direction of enhancing the supply and demand for millets. This is however, yet to be implemented at the ground level although a few states have taken a lead on this under state level policies (for example Maharashtra and Karnataka states). The other factors that constrain sorghum consumption are difficulty in preparation of sorghum bread flat breads (*roties* is the form in which sorghum is consumed) and longer cooking time. Surprisingly, difficulty in preparation of sorghum bread (77% in rural localities of western Maharashtra) is one of the major constraining factors expressed by rural households. Generally, it is understood that urban households find it difficult to cook traditional food items but the indications from empirical findings suggest that even rural households have cooking issues might be attributed to changing lifestyles and penetration of fast food even in rural localities

To understand the perceptions of consumers on enhancing the demand for sorghum, consumers are asked to suggest the available options. As the views vary from one consumer to other, the suggestions are exhaustive. The views expressed by sample consumers are classified into 9-10 broad categories by the researchers. The suggestions ex-

**Table 9. Purchase frequency of sorghum by households in HOPE clusters**

| Frequency | Western | | Marathwada | |
|---|---|---|---|---|
| | Rural | Urban | Rural | Urban |
| Weekly | 15 | 6 | 5 | 13 |
| Monthly | 9 | 14 | 11 | 14 |
| Half-yearly | 3 | 13 | 2 | 0 |
| Yearly | 10 | 32 | 18 | 34 |
| Occasionally | 1 | 6 | 0 | 0 |
| Never | 62 | 28 | 65 | 38 |
| None | 0 | 1 | 0 | 0 |
| Total | 89 | 90 | 102 | 91 |

**Table 10. Visible attribute preferences of consumers of sorghum in HOPE clusters**

| Visible attributes of grain | Western | | | | Marathwada | | | |
|---|---|---|---|---|---|---|---|---|
| | Rural | | Urban | | Rural | | Urban | |
| | Rank 1 | Rank 2 | Rank 1 | Rank 2 | Rank 1 | Rank 2 | Rank 1 | Rank 2 |
| Size of grain | 24 | 33 | 49 | 17 | 25 | 17 | 40 | 11 |
| Color | 43 | 20 | 17 | 43 | 15 | 26 | 16 | 40 |
| Cleanliness | 0 | 15 | 6 | 18 | 9 | 12 | 9 | 16 |
| Total sample households | 89 | 90 | 102 | 91 | | | | |

pressed by consumers varied in both the regions based on the constraints faced by the consumer in their regions. Interestingly, in both the regions supply of sorghum through public distribution system (PDS) especially for rural households is one of the major suggestion (40-43%of the respondents) to enhance the consumer demand (Table 14). As expected, the %age of household expressing this as a suggestion is low by urban households of western Maharashtra. The second important suggestion in western Maharashtra particularly by urban households is to supply sorghum in small packages of 5-10 kg. This suggestion comes from the fact that urban household consume sorghum less frequently and buy in smaller proportion as and when required. The constraint in-terms of non-availability of processed sorghum (cleaned, graded and packed) in comparison to other commodities (which are available in 1-2 kg packets) has probably influenced consumers for such a suggestion. In Marathwada region increased production is an important suggestion by 27% of the rural households. This might probably be due to high fluctuations in production and prices leading to lower availability of sorghum over the last 3-4 years. The low production over past 3-4 years has resulted in high prices leading to

*Enhancing the market demand for sorghum-Consumer's suggestions*

Consumers suggestion for low and stable prices of sorghum. Improvement in processing of sorghum (availability of packed flour in small quantity in retail outlets and food bazars) is the other impor-

**Table 11. Invisible attribute preferences of consumers of sorghum in HOPE clusters**

| Invisible attributes of flour | Western | | | | Marathwada | | | |
|---|---|---|---|---|---|---|---|---|
| | Western | | | | Marathwada | | Urban | |
| | Rural | Urban | Rural | Urban | Rank 1 | Rank 2 | Rank 1 | Rank 2 |
| | Rank 1 | Rank 2 | Rank 1 | Rank 2 | Rank 1 | Rank 2 | Rank 1 | Rank 2 |
| Keeping quality | 37 | 24 | 40 | 19 | 37 | 11 | 43 | 9 |
| Ease of preparation | 7 | 12 | 13 | 22 | 0 | 7 | 3 | 12 |
| Elasticity of dough | 8 | 9 | 13 | 20 | 2 | 4 | 0 | 5 |
| Better taste | 20 | 22 | 13 | 19 | 15 | 26 | 18 | 30 |
| Total sample households | 89 | 90 | 102 | 91 | | | | |

**Table 12. Factors influencing sorghum consumption in HOPE clusters**

| Factors | Western | | Marathwada | |
|---|---|---|---|---|
| | Rural | Urban | Rural | Urban |
| Staple food | 52 | 48 | 59 | 41 |
| Less expensive compared to other cereals | 65 | 35 | 43 | 57 |
| Health conscious | 40 | 60 | 52 | 48 |
| Good taste and nutritious food | 53 | 47 | 53 | 47 |
| Others (easy digestibility) | 43 | 57 | 51 | 49 |

*Note:Shares are calculated as the household response to total number of responses (both rural & urban)*

**Table 13. Factors constraining sorghum consumption in HOPE clusters**

| Factors | Western | | Marathwada | |
|---|---|---|---|---|
| | Rural | Urban | Rural | Urban |
| Availability of subsidized rice & wheat through PDS | 17 | 63 | 89 | 77 |
| Difficulty in preparation of sorghum roties | 77 | 55 | 40 | 35 |
| Longer cooking time (more fuel) | 53 | 63 | 31 | 54 |
| Readily available ready to eat food items | 33 | 12 | 18 | 28 |
| Others (easy digestibility) | 43 | 57 | 51 | 49 |

tant suggestion coming from urban household of western region. On an average about 13% of the sample rural households of western Maharashtra suggested for supply of sorghum grain in homogenous quality. There are lots of sorghum varieties (*Maldhani, Jute, Dagdi, Swati, and Vasanth*), traded in markets. The varieties traded vary from market to market based on the consumer preferences. Since there is a large variation observed in quality of a given variety, generally grading is

done before selling. Different grades of sorghum are preferred for different uses and by different class of people (high income, middle income and labor class). If *Maldhani* as a variety is preferred and traded in Marathwada, it could be *jute* in western Maharashtra. Hence, due to such variation observed in quality of sorghum there is a huge variation in prices of sorghum which could range from Rs 20/kg to Rs 3/kg.

Dependency on sorghum for consumption in the consumption basket in general is higher for poorer households in Maharashtra. However, evidence shows that in the districts of Marathwada Maharashtra, sorghum for consumption is a staple irrespective of the incomes of the households. Inverse relation between income and sorghum consumption is less evident among rural households. The findings from the regression analysis indicate income as significant variable influencing consumption positively. Though sorghum is a staple for consumption in urban households also given their perception of health benefits of sorghum consumption, they are less frequent consumers as compared to their rural counterparts. The underlying factors for this are lack of time for cooking sorghum bread as both men and women are employed in urban locations; skill sets required for preparation; easy availability of diversified products from rice and wheat; non-availability of diversified ready to eat products of sorghum etc. These factors to a large extent have contributed to the decline in sorghum consumption. Hence, efforts to enhance and stimulate the demand of sorghum have to be thought off. Sorghum value addition and development of diversified ready to use products of sorghum will help in better penetration of sorghum in the consumption basket of the households and arrest the declining consumption in the long run.

Owing to surge in medical problems such as diabetes and coronary heart diseases consumer's awareness toward health is increasing. A reaction to this has been the entry of private processing industries to develop value added products and nutriceutical (flakes, energy bars, multigrain biscuits etc) products from barley, finger millet and maize targeting the urban consumer. This also enhances consumer

**Table 14. Factors to enhance sorghum consumption demand- Consumers suggestions from HOPE clusters**

| Suggestion | Western | | Suggestion | Marathwada | |
|---|---|---|---|---|---|
| | Rural | Urban | | Rural | Urban |
| Supply through PDS | 40.45 | 27.7 | Supply through PDS | 41. 1 | 43 |
| Awareness | 0 | 1 | Awareness | 9.8 | 11 |
| Price reduction | 3.3 | 2. 2 | Price reduction | 5.8 | 9.8 |
| Improve processing | 4.5 | 20.0 | Improve processing | 7.8 | 9.8 |
| Availability of quality sorghum in small packets | 18 | 24.4 | Easy availability | 0.9 | 1. 1 |
| Direct sales from producer to consumer | 0 | 5.5 | Good quality | 0.9 | 0.0 |
| Homogeneous product of sorghum | 13.4 | 9.0 | Increase production | 27.4 | 17.5 |
| Sales in food bazars | 6.74 | 3.3 | Subsidy on inputs | 4.9 | 4.4 |
| Supply through Co-operative society/ Marketing | 9.0 | 2. 2 | | | |
| None | 4.5 | 4.4 | None | 0.9 | 3.3 |
| Total | 100 | 100 | Total | 100 | 100 |

demand for sorghum and opportunity for farmers to market their produce through appropriate market linkages. The other such avenues include the recently introduced Food Security Bill of Government of India to distribute millets through the scheme, supply of cleaned, graded and packed sorghum in small packets of 2-5kg and improving the shelf life of flour will help in enhancing and stimulating the consumer demand.

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