# FARMING SYSTEM FOR NUTRITION:

# NEED AND SCOPE IN MAHARASHTRA

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**July 2018**

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**Chennai**

**MSSRF / RR / 18 / 48**

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## Abbreviations

| | |
|---|---|
| **ADB** | Asian Development Bank |
| **APMC** | Agriculture Produce Marketing Committee |
| **ATMA** | Agriculture Technology Management Agency |
| **AWCs** | Anganwadi Centres |
| **BCC** | Behaviour Change Communication |
| **BMI** | Body Mass Index |
| **CCSAMMN** | Climate Change and Sustainable Agriculture Monitoring, Modelling and Networking |
| **CED** | Chronic Energy Deficiency |
| **CROPSAP** | Crop Pest Surveillance and Advisory Project |
| **CSR** | Corporate Social Responsibility |
| **CU** | Consumer Unit |
| **FSN** | Farming System for Nutrition |
| **FPO** | Farmer Producer Organization |
| **GCA** | Gross Cropped Area |
| **GDP** | Gross Domestic Product |
| **IFS** | Integrated Farming System |
| **ICAR** | Indian Council of Agricultural Research |
| **ICDS** | Integrated Child Development Services |
| **ICMR** | Indian Council of Medical Research |
| **ICRISAT** | International Crops Research Institute for the Semi-Arid Tropics |
| **IFAD** | International Fund for Agriculture Development |
| **IMR** | Infant Mortality Rate |
| **INM** | Integrated Nutrient Management |
| **INSIMP** | Initiative for Nutritional Security through Intensive Millets Promotion |
| **IWMP** | Integrated Watershed Management Programme |
| **KVK** | Krishi Vigyan Kendra |
| **MGNREGA** | Mahatma Gandhi National Rural Employment Guarantee Act |
| **MIDH** | Mission for Integrated Development for Horticulture |
| **MIS** | Management Information System |

| | |
|---|---|
| **MIYCN** | Maternal, Infant and Young Child Nutrition |
| **MMR** | Maternal Mortality Rate |
| **MPKV** | Mahatma Pule Krishi Vidyapeeth |
| **MSSRF** | M. S. Swaminathan Research Foundation |
| **NABL** | National Accreditation Board for Testing & Calibration Laboratories |
| **NFSM** | National Food Security Mission |
| **NLM** | National Livestock Mission |
| **NMAET** | National Mission for Agriculture Extension and Technology |
| **NMSA** | National Mission for Sustainable Agriculture |
| **NRCs** | National Rehabilitation Centres |
| **NSSO** | National Sample Survey Organisation |
| **PACS** | Primary Agricultural Credit Societies |
| **PKVY** | Paramparagat Krishi Vikas Yojana |
| **PoCRA** | Project on Climate Resilient Agriculture |
| **PPP** | Public Private Partnership |
| **RDA** | Recommended Dietary Allowance |
| **RDI** | Recommended Dietary Intake |
| **RJMCHNM** | Rajmata Jijau Mother Child Health and Nutrition Mission |
| **RKVY** | Rashtriya Krishi Vikas Yojana |
| **SC** | Scheduled Caste |
| **SHC** | Soil Health Card |
| **SHGs** | Self-Help Groups |
| **ST** | Scheduled Tribe |
| **UNICEF** | United Nations Children's Fund |
| **VDCs** | Village Development Councils |
| **WHO** | World Health Organization |

## Acknowledgements

Our Founder Chairman, Prof. M. S. Swaminathan, who developed the concept of Farming System for Nutrition (FSN), has given us immense support in our current engagement of advocacy for the FSN approach to address the problem of malnutrition in the states of Andhra Pradesh, Bihar, Maharashtra and Odisha. I am extremely grateful to him for the interest he took in our work and for his constant guidance, encouragement and above all the trust he placed in me and my team.

Completing the project requirements across four target States, within a short span of eighteen months, has been possible only because of the commitment, sincerity and hard work of my team comprising of G. Anuradha, R. Gopinath, A. Sakthi Velan, Samyuktha Kannan, R. Sanjeev and Varun Kumar Yadav. Conducting orientation and advocacy events on FSN, for different stakeholders, was a key method adopted in this project. In this, R. Gopinath played a pivotal role in building rapport with senior government officers, networking with concerned institutions and organising the events. G. Anuradha took on the crucial responsibility of preparing a range of background and dissemination material and developing and maintaining the web related communication. Preparation of Reports pertaining to each of the target States, such as the current report, "*Farming System for Nutrition: Need and Scope in Maharashtra*" is an important output of the project. My co-authors – G. Anuradha, R. Gopinath and Samyuktha Kannan – have drafted different sections: the core section, the Policy Landscape Analysis, was conceived and written by Samyuktha Kannan; the Nutritional Profile by G. Anuradha; and Agricultural Profile by R. Gopinath. Information on biofortified crops was compiled by R. Sanjeev; Varun Kumar Yadav compiled and analysed relevant data and documents and provided overall assistance. A. Sakthi Velan provided meticulous secretarial assistance. I acknowledge with thanks the valuable contribution of each of my teammates.

Dr. Prakash Shetty, CEO, LANSA, provided guidance and encouragement all through; R. V. Bhavani and L. Vedavalli at MSSRF supported in many different ways; the Executive Director and other colleagues at the MSSRF have provided all necessary support; members of the Technical Advisory Committee of the project have provided guidance; and the Tata Trusts provided financial support without which this work would not have been possible; my sincere thanks to all.

Senior officials from the Government of Maharashtra have been extremely supportive and receptive to the concept of FSN. They willingly gave their time and allowed us to share our findings and recommendations for promoting FSN in Maharashtra. We are particularly thankful to Shri. Bijay Kumar, IAS, Additional Chief Secretary, Department of Agriculture and Marketing and Shri. Sachindra Pratap Singh, IAS, Commissioner, Dept of Agriculture, Govt. of Maharashtra. We thank Dr. K. M. Nagargoje, IAS (Retd.) and former Director General, Maharashtra Council of Agricultural Education and Research (MCAER) and faculty members from Yashwantrao Chavan Academy of Development Administration (YASHDA), for their support in organising advocacy workshops in Pune. The Central Institute of Fisheries Education, Mumbai, ICAR-Agricultural Technology Application Research Institute, Pune, and Mahatma Phule Krishi Vidyapeeth, Rauri have been very supportive and our heartfelt thanks to them.

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# Section 1:

# INTRODUCTION

One of the major issues concerning India is the persistent problem of malnutrition, particularly among children and women. Over the several decades of planned development, many different programmes and schemes have been put in place to tackle the problem of malnutrition across different age groups of population, and focusing on infancy, childhood, adolescence and women in their reproductive years. In spite of various efforts, including rapid advances made in food production, malnutrition persists in India at unacceptable levels. Stunting, wasting and underweight among children, and anaemia and chronic energy deficiency among women, remain key public health challenges in India. The prevalence of malnutrition in India has accompanied a reduction in diversity of food crop production over the years. There has been a tendency towards cereal-dominant farming systems of rice and wheat, with a decline in production of a variety of millets and pulses over time, in the country.

Malnutrition is caused by multiple factors and any approach to tackle the problem of malnutrition would require a holistic, multidimensional approach. A combination of nutrition specific interventions and nutrition sensitive interventions is required to address malnutrition[1]. The widely accepted United Nations Children's Fund's conceptual framework identifies household food insecurity as one of the underlying causes of malnutrition (UNICEF, 2017). For much of India's rural population dependent on agriculture and allied activities, household food security and nutrition is closely linked to farm diversity, productivity and profitability.

The M. S. Swaminathan Research Foundation (MSSRF) promotes Farming System for Nutrition (FSN) as a pathway for addressing malnutrition in India. The FSN approach is defined by M. S. Swaminathan as:

> ***"The introduction of agricultural remedies to the nutritional maladies prevailing in an area through mainstreaming nutritional criteria in the selection of the components of a farming system involving crops, farm animals and wherever feasible, fish".*** (Nagarajan et. al. 2014)

[1] Nutrition-specific interventions address the immediate causes of undernutrition, like inadequate dietary intake and some of the underlying causes like feeding practices and access to food. Nutrition-sensitive interventions address some of the underlying and basic causes of malnutrition by incorporating nutrition goals and actions from a wide range of sectors such as agriculture, education and social welfare UNICEF (2017).

The FSN approach comprises a combination of measures including advanced crop production practices, biofortification[2], promotion of kitchen gardens of fruits and vegetables, livestock and poultry development, and setting up of small-scale fisheries, combined with nutrition awareness. Primarily, the approach calls for the promotion of location-specific farming systems that integrate arable farming, horticulture, backyard farming and animal farming to sustainably improve household availability of nutrition while also mitigating risk and conserving natural resources. In developing a design for the farming system, feasible agricultural interventions to address the nutritional deficiencies of the household/community/location would have to be incorporated. In the words of M. S. Swaminathan, ".....the design of the farming system [can] include specific crop varieties that can address the identified deficiencies. Sweet potato might provide vitamin A, drumstick tree (*moringa olifera*) and *Amaranthus sp.* could address the lack of iron." (Rao and Swaminathan, 2017) In addition, the approach recognises the need for other direct interventions – to improve production and market linkages for nutritious crops - and indirect interventions – to improve women's empowerment, nutrition, education, drinking water, sanitation and natural resource management, along the pathway from agriculture to nutrition (Das et al., 2014; Gillespie and Kadiyala, 2012; Shetty, 2015).

In the Indian context where malnutrition levels are closely linked to inadequacy in food intake as well as lack of balanced diet among the rural population, the FSN approach that promotes on-farm production diversity has the potential to enhance consumption diversity. However, given the magnitude of the problem of malnutrition, the FSN approach has to become a state initiative to contribute towards enhancing food security and nutrition for large sections of the population. There is thus a pressing need to reorient agricultural policies towards achieving nutritional goals. Agricultural policies can affect nutrition through different pathways, such as through food production, or agricultural income or women's empowerment. Agricultural policymaking across the different domains should become more nutrition-sensitive and aim to unite the twin goals of agricultural growth and nutritional improvements (Gillespie & Kadiyala, 2012).

[2] Biofortification is a process by which the nutritional quality of food crops is improved through agronomic practices, conventional plant breeding or modern biotechnology (WHO, 2016).

The Farming System for Nutrition approach can be seen as encompassing eight distinct domains. At its core, the approach calls for improving agricultural production diversity by incorporating an integrated farming system involving crops, livestock and aquaculture in the field or in the homestead. Other core domains that can directly improve the local availability of deficient nutrients include agricultural production, biofortification and agricultural value chains. Indirect or non-core domains that supplement the food related processes, include nutrition-education, women's empowerment, sanitation, hygiene and safe drinking water and natural resource management (**Fig 1.1**).

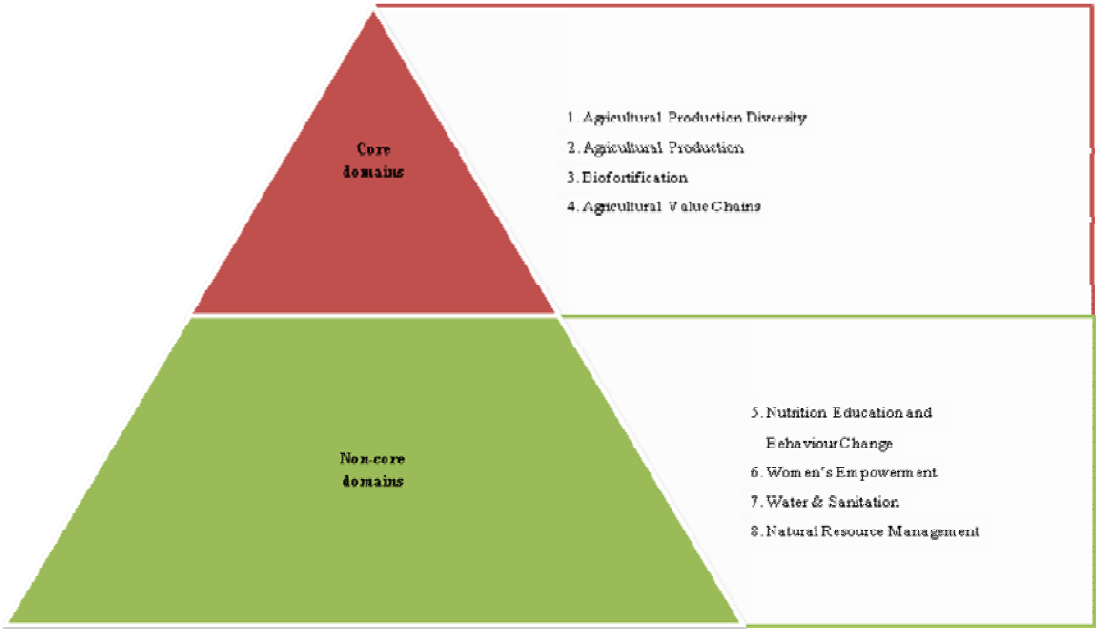



**Fig. 1.1. Domains of *Farming System for Nutrition***

MSSRF has been engaged in advocacy for a FSN approach in four selected states-Andhra Pradesh, Bihar, Maharashtra and Odisha and has undertaken a policy landscape analysis to explore the scope for FSN in these states (For details see http://mssrf-fs-fsn.com/).

This Report discusses the need and scope for a FSN approach in the state of Maharashtra. One of the economically most developed states of India with relatively high levels of industrialisation and urbanisation, agricultural development in Maharashtra is marked by significant regional variation with respect to production, productivity and modernisation. Although agriculture and allied activities contributed only 11.4% of the Gross State Value Added in 2016-17, it continues to employ 55% of the labour force (GoM, 2018a). In recent

years the rapid economic expansion of the state has been marred by water scarcity, agrarian distress and farmer suicides. Malnutrition, particularly among children and women, remains a major concern in Maharashtra. The state government has formulated a State Vision for 2030 to leverage its investments and industries towards 'sustainable, equitable and balanced economic growth'.

The Report is organised in six sections: The current section, discusses the context and perspective on FSN; sections 2 and 3 discuss aspects relating to the nutritional and agriculture status of Maharashtra; section 4 provides details on biofortified crops suitable for adoption in Maharashtra; section 5 provides a desk review of government policies (central and state) that foster nutrition-sensitive agriculture in the state of Maharashtra; and section 6 provides the policy recommendations for promoting farming system for nutrition approach in Maharashtra.

# Section 2:

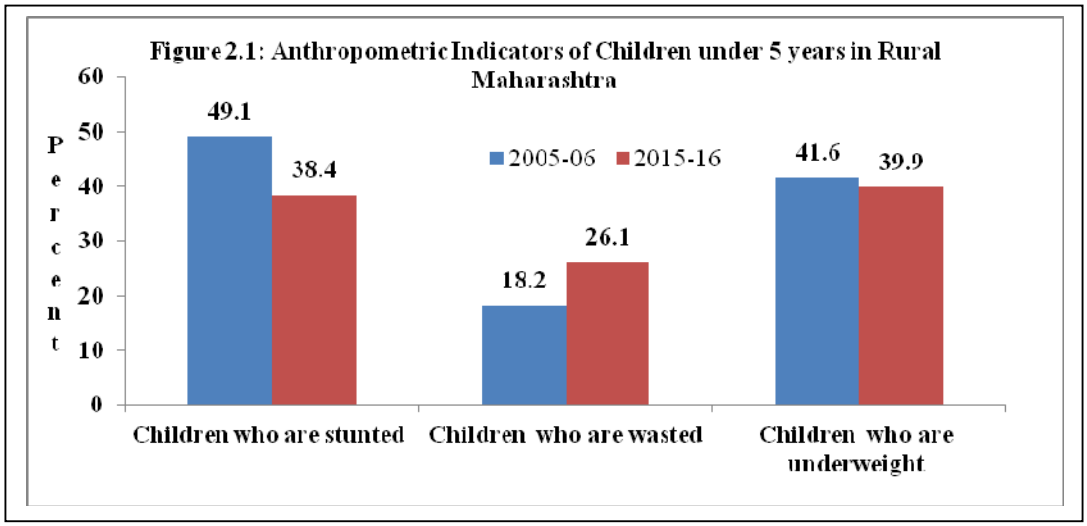
# NUTRITIONAL PROFILE OF MAHARASHTRA

## 2.1 Nutritional Status of Children and Women

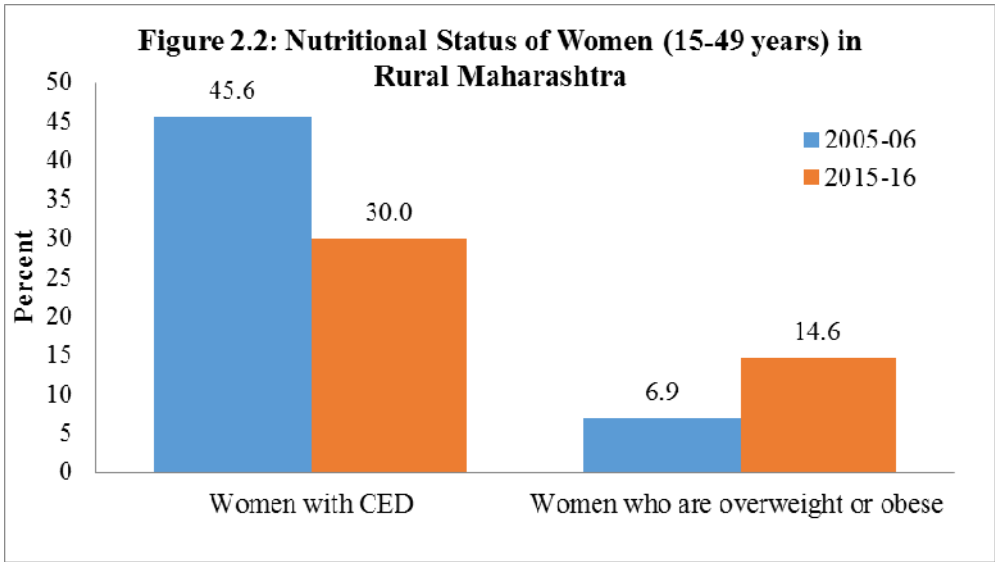
Maharashtra had undertaken a mission mode approach, with the initiation of Rajmata Jijau Mother-Child Health and Nutrition Mission (RJMCHNM) in 2005, to tackle nutritional problems. Nutritional status of children, less than 5 years of age in the state improved considerably by some measures but not by all measures, between 2005-06 and 2015-16. Similarly, malnourishment among women in the reproductive age group (15-49 yrs), measured using the Body Mass Index (BMI), showed decline but prevalence of anaemia recorded an increase over the last decade.

As is clear from **Figure 2.1**, stunting (too short for their age) declined appreciably and underweight (thin for their age) decreased very marginally while wasting (too thin for their height) recorded an increase during the same period. Even with the decline in stunting and underweight levels, nearly two-fifths of children remained stunted and underweight in 2015-16. Child malnutrition is therefore still is a major problem in Maharashtra. **Figure 2.2** shows a decline in percentage of women with Chronic Energy Deficiency (CED) as well as increase in percentage of women who are obese or overweight in rural Maharashtra. Recent years have also witnessed an increasing trend in lifestyle related non-communicable diseases in rural Maharashtra. Around 15% of rural women and men in the age group 15-49 years are overweight or obese and 11% of the women are reported to experience high blood pressure levels in rural Maharashtra.

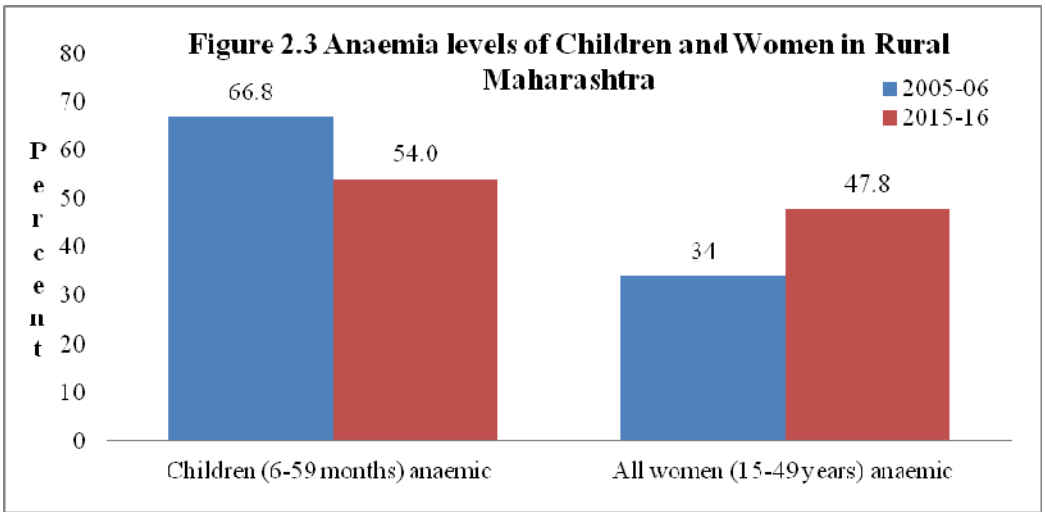
**Figure 2.3** shows a decline in percentage of children suffering from anaemia while there is an increase in percentage of women suffering from anaemia. Though anaemia levels among children recorded a decline, more than half of the children less than five years of age (54%), continue to suffer from any anaemia in 2015-16. Thus anaemia among women of reproductive age and children (6-59 months) remains a key area of concern. Overall, it is clear that the problem of malnutrition remains enormous in Maharashtra.




Source: IIPS, 2007 and IIPS-ICF, 2017

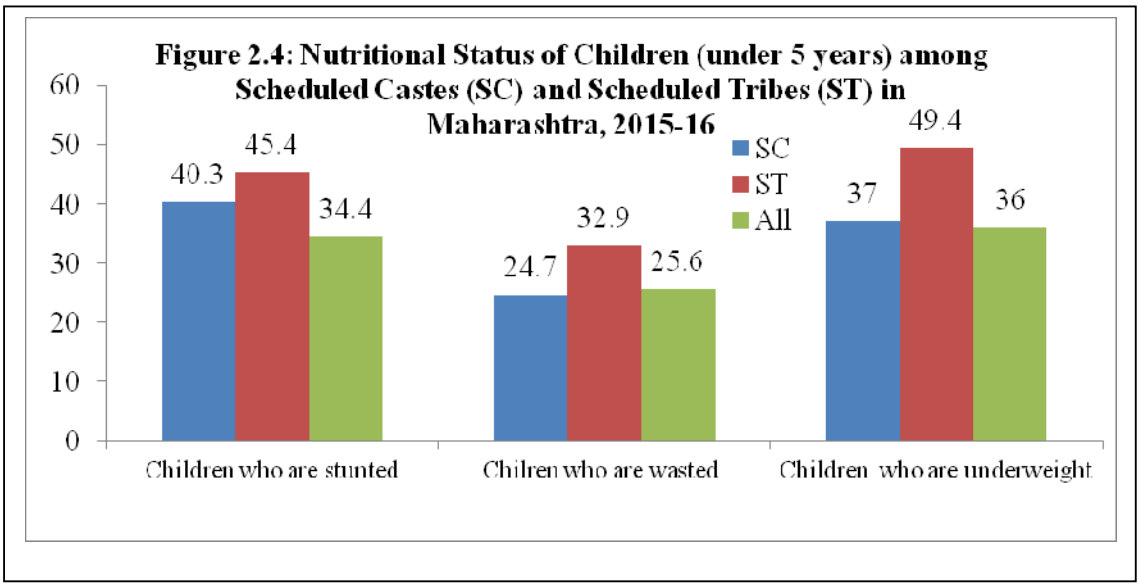



Source: IIPS, 2007 and IIPS-ICF, 2017




Source: IIPS, 2007 and IIPS-ICF, 2017

The nutrition status of women and children vary across social groups. **Figure 2.4** shows that the problem of stunting, wasting and underweight on children is most severe among the Scheduled Tribe (ST) category.




Source: IIPS-ICF, 2017

**Table 2.1** provides the nutritional status of children and women in rural areas, across districts of Maharashtra.

**Table 2.1: Nutrition Status of Children and Women across districts, Rural Maharashtra, 2015-16 (Fig in percentage)**

| Sl. No: | Name of the District | Children under 5 years who are stunted | Children under 5 years who are wasted | Children under 5 years who are underweight | Children age 6-59 months who are anaemic | Women 15-49 years with CED | Non – Pregnant women age 15-49 years who are anaemic |
|---|---|---|---|---|---|---|---|
| 1. | Ahmednagar | 34.7 | 21.9 | 32.5 | 43.4 | 25.6 | 44.8 |
| 2. | Akola | 47.7 | 25.0 | 45.4 | 50.5 | 27.0 | 37.8 |
| 3. | Amravati | 42.1 | 28.7 | 37.8 | 48.8 | 29.9 | 45.5 |
| 4. | Aurangabad | 41.3 | 15.7 | 34.5 | 43.6 | 28.2 | 47.4 |
| 5. | Beed | 37.6 | 32.2 | 36.8 | 58.6 | 21.7 | 33.6 |
| 6. | Bhandara | 38.2 | 17.9 | 30.6 | 45.4 | 35.9 | 57.2 |
| 7. | Buldhana | 46.2 | 20.4 | 41.9 | 44.1 | 29.6 | 44.3 |
| 8. | Chandrapur | 34.0 | 34.6 | 40.5 | 61.4 | 37.1 | 49.8 |
| 9. | Dhule | 42.1 | 30.2 | 51.1 | 68.6 | 31.9 | 53.3 |
| 10. | Gadchiroli | 30.9 | 46.7 | 40.2 | 59.8 | 28.9 | 51.0 |
| 11. | Gondia | 34.5 | 31.3 | 41.7 | 57.2 | 38.3 | 56.5 |
| 12. | Hingoli | 40.2 | 24.9 | 37.6 | 53.6 | 30.4 | 42.7 |
| 13. | Jalgaon | 38.4 | 32.9 | 37.4 | 64.8 | 20.6 | 52.2 |
| 14. | Jalna | 47.0 | 21.9 | 44.3 | 49.3 | 29.9 | 42.8 |
| 15. | Kolhapur | 30.6 | 27.8 | 32.7 | 45 | 26.7 | 47.0 |
| 16. | Latur | 37.1 | 24.6 | 37.9 | 56.3 | 25.3 | 37.1 |
| 17. | Nagpur | 34.0 | 28.6 | 38.5 | 47.4 | 31.8 | 50.7 |
| 18. | Nanded | 42.9 | 19.6 | 36.1 | 54.7 | 34.2 | 45.6 |
| 19. | Nandurbar | 49.7 | 40.4 | 57 | 60.8 | 45.3 | 61.6 |
| 20. | Nashik | 43.2 | 32.9 | 51.3 | 54.0 | 32.2 | 52.9 |
| 21. | Osmanabad | 44.0 | 19.0 | 44.4 | 37.1 | 23.7 | 33.6 |
| 22. | Parbhani | 48.5 | 22.0 | 44.7 | 54.4 | 37.5 | 45.7 |
| 23. | Pune | 22.5 | 19.3 | 27.9 | 53.8 | 23.4 | 49.3 |
| 24. | Raigad | 39.5 | 22.4 | 41.0 | 56.4 | 31.0 | 61.1 |
| 25. | Ratnagiri | 27.0 | 23.6 | 29.2 | 50.9 | 33.3 | 47.1 |
| 26. | Sangli | 25.9 | 18.1 | 25.1 | 51.4 | 24.2 | 49.3 |
| 27. | Satara | 24.3 | 24.5 | 29.6 | 57.8 | 33.9 | 47.0 |
| 28. | Sindhudurg | 27.8 | 20.9 | 28.0 | 37.2 | 31.6 | 42.9 |
| 29. | Solapur | 24.2 | 25.6 | 37.1 | 52.2 | 20.2 | 41.9 |
| 30. | Wardha | 29.7 | 24.8 | 33.5 | 45.9 | 31.4 | 42.7 |
| 31. | Washim | 41.8 | 33.3 | 44.1 | 63.7 | 28.4 | 36.4 |
| 32. | Yavatmal | 53.4 | 25.3 | 53.4 | 73.7 | 30.3 | 48.9 |
| | **Maharashtra** | **38.4** | **26.1** | **39.9** | **54.0** | **30.0** | **47.8** |

Note: CED – Body Mass Index < 18.5 kg/$m^2$; Child Anaemia - Haemoglobin level < 11.0 grams/decilitre and Non-pregnant women anaemia – Haemoglobin level <12 gm/dl
Source: IIPS-ICF, 2017

**Table 2.1** reflects the large variation in the intensity of nutritional problems across districts. In order to understand if there are spatial patterns to the nutritional problems, an exercise at grouping the districts based on their nutritional performance was attempted. In grouping the districts, the values for each indicator, viz. stunting, wasting underweight, anaemia and CED was classified into five categories using equal interval classes based on the level of the problem, namely, very low, low, moderate, high and very high. Districts with lower value had relatively lower problems while districts with higher values reflect relatively higher extent of the problem. In the maps the darker shaded districts indicate relatively higher intensity of nutritional problem than the lighter shaded districts. (**Tables 2.2 to 2.7** and **Figures 2.5 to 2.9**)

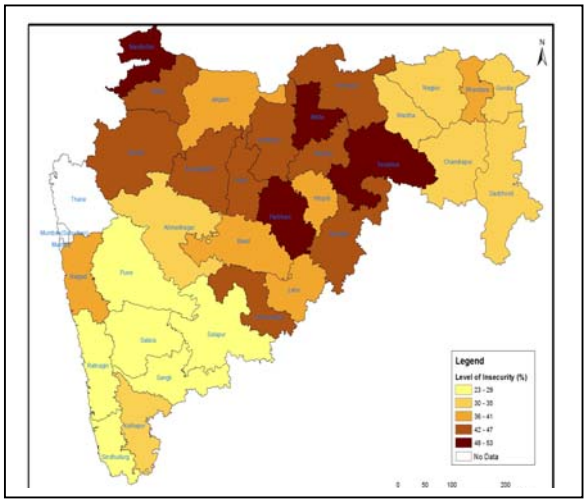
2.1.1 District-wise levels of malnutrition among children in rural Maharashtra

**Table 2.2: Categorisation of districts by Level of Insecurity w.r.to Child Stunting, Rural Maharashtra, 2015-16**

| Level of Insecurity | Names of Districts |
|---|---|
| Very Low | Pune, Solapur, Satara, Sangli, Ratnagiri, Sindhudurg |
| Low | Wardha, Kolhapur, Gadchiroli, Chandrapur, Nagpur, Gondia, Ahmednagar, |
| Moderate | Latur, Beed, Bhandara, Jalgaon, Raigad, Hingoli |
| High | Aurangabad, Washim, Amravati, Dhule, Nanded, Nasik, Osmanabad, Buldhana, Jalna |
| Very High | Akola, Parbhani, Nandurbar, Yavatmal |

Note: Percentage of children stunted in different categories is as follows: 23-29% in very low; 30-35% in low; 36-41% in moderate; 42-47% in high and 48-53% in very high.
Source: Table 2.1

**Fig 2.5 Percentage of Children Stunted**




Percentage of stunted children varies widely across the districts of rural Maharashtra from a minimum of 22.5 in Pune to a maximum of 53.4 in Yavatmal in 2015-16. Six districts fall in the very low intensity of problem category with less than one third percentage of children stunted. On the contrary, in 15 out of 32 districts, the problem is much

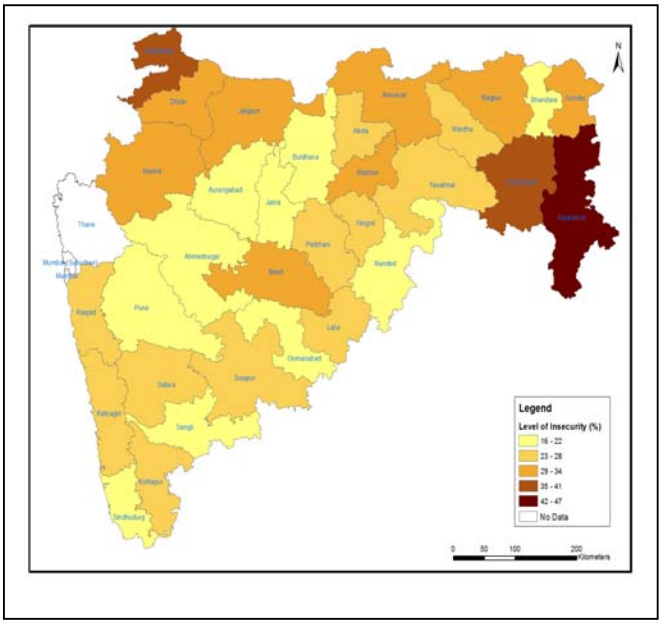
worse than the state average of 38.4 %. More than two-fifth of rural children who are stunted, are in the 'high' and 'very high', intensity category.

**Table 2.3: Categorisation of districts by Level of Insecurity w.t.to Child Wasting, Rural Maharashtra, 2015-16**

| Level of Insecurity | Names of Districts |
|---|---|
| Very Low | Aurangabad, Bhandara, Sangli, Osmanabad, Pune, Nanded, Buldhana, Sindhudurg, Ahmednagar, Jalna |
| Low | Parbhani, Raigad, Ratnagiri, Satara, Latur , Wardha, Hingoli, Akola, Yavatmal, Solapur, Kolhapur |
| Moderate | Nagpur, Amravati, Dhule, Gondia, Beed, Jalgaon, Nashik, Washim |
| High | Chandrapur, Nandurbar |
| Very High | Gadchiroli |

Note: Percentage of children wasted in different categories are as follows: 16-22% in very low; 23-28% in low; 29-34% in moderate; 35-41% in high and 42-47% in very high.
Source: Table 2.1

**Fig 2.6 Percentage of Children Wasted**



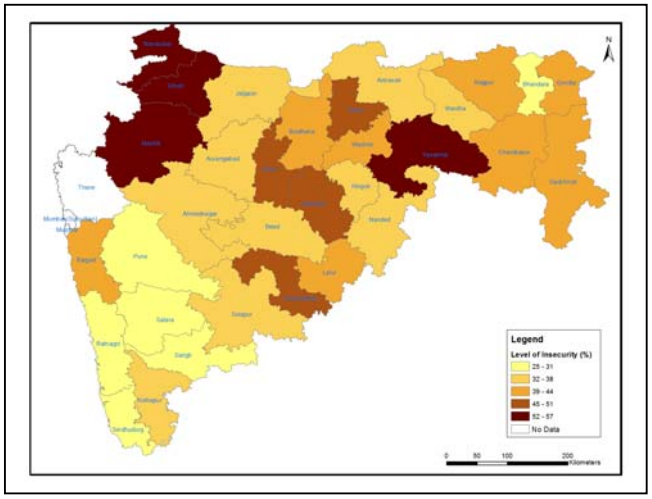

Percentage of children who are wasted varies widely across the districts of rural Maharashtra with a minimum of 16% in Aurangabad to a maximum of 47% in Gadchiroli in 2015-16. 10 out of 32 districts fall in the very low insecurity category as the percentage of children wasted is lower than one-fourth in these districts. On the contrary Chandrapur, Nandurbar and Gadchiroli are three districts that have more than 35% of children who are wasted. The average percentage of wasted children in rural Maharashtra is 26.1 and it is clear that in 12 districts in the moderate, high and very high insecurity categories, the problem is worse than the state average.

**Table 2.4: Categorisation of districts by Level of Insecurity w.r.to Child Underweight, Rural Maharashtra, 2015-16**

| Level of Insecurity | Name of Districts |
|---|---|
| Very Low | Sangli, Pune, Sindhudurg, Ratnagiri, Satara, Bhandara |
| Low | Ahmednagar, Kolhapur, Wardha, Aurangabad, Nanded, Beed, Solapur, Jalgaon, Hingoli, Amravati |
| Moderate | Latur, Nagpur, Gadhiroli, Chandrapur, Raigad, Gondia, Buldhana, Washim |
| High | Jalna, Osmanabad, Parbhani, Akola |
| Very High | Dhule, Nashik, Yavatmal, Nandurbar |

Note: Percentage of children underweight in different categories are as follows: 25 -31% in very low; 32-38% in low; 39-44% in moderate; 45-51% in high and 52-57% in very high.
Source: Table 2.1

**Fig 2.7 Percentage of Children Underweight**




Percentage of underweight children varies widely across the districts of rural Maharashtra with a minimum of 25% in Sangli to a maximum of 57% in Nandurbar, with the state average at 39.9% in 2015-16. Sangli, Pune, Sindhudurg, Ratnagiri, Satara and Bhandara districts fall in the very low insecurity category as the percentage of underweight children are relatively lower in these districts. On the contrary, Dhule, Nashik, Yavatmal and Nandurbar districts have more than 52% of children who are underweight. The percentage of underweight children in 14 districts is above the state average and mostly falls in the high and very high insecurity categories.

Anaemia is also a major health problem in Maharashtra, especially among women and children[3], as mentioned earlier and as seen from the figures in table 2.1.

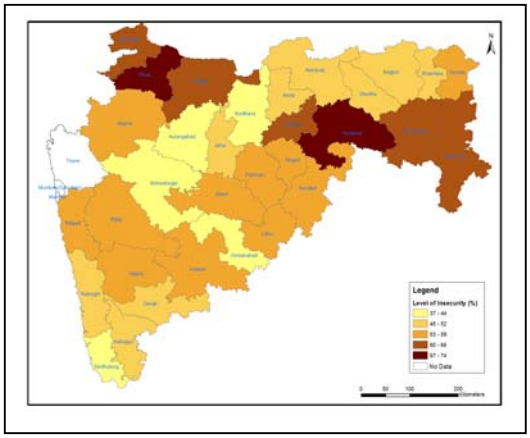
3 Anaemia is a condition that is marked by low levels of haemoglobin in the blood. Iron deficiency is the major cause for anaemia with malaria, hookworms, other nutritional deficiencies, chronic infections, and genetic conditions being other contributors. Anaemia can result in weakness, diminished physical and mental capacity, and increased morbidity from infection, etc among children and women (IIPS-ICF, 2017).

**Table 2.5: Categorisation of districts by Level of Insecurity w.r.to anaemia in children, Rural Maharashtra, 2015-16**

| Level of Insecurity | Name of Districts |
|---|---|
| Very Low | Osmanabad, Sindhudurg, Ahmednagar, Aurangabad, Buldhana |
| Low | Kolhapur, Bhandara, Wardha, Nagpur, Amravati, Jalna, Akola, Ratnagiri, Sangli |
| Moderate | Solapur, Hingoli, Pune, Nashik, Parbhani, Nanded, Latur, Raigad, Gondia, Satara, Beed |
| High | Gadchiroli, Nandurbar, Chandrapur, Washim, Jalgaon |
| Very High | Dhule, Yavatmal |

Note: Percentage of children anaemic in different categories are as follows: 37-44% in very low; 45-52% in low; 53-59% in moderate; 60-66% in high and 67-74% in very high.
Source: Table 2.1

**Fig 2.8 Percentage of Children with Anaemia**




Percentage of children who are anaemic in rural Maharashtra varies widely across the districts with a minimum of 37% in Osmanabad and a maximum of 74% in Yavatmal. On an average, 54% of children are anaemic in rural Maharashtra. 11 districts which largely fall in the high and very high insecurity categories have higher percentages of children who are anaemic than the state average. Osmanabad, Sindhudurg, Ahmednagar, Aurangabad and Buldhana districts have relatively lower percentage of children with anaemia while Gadchiroli, Nandurbar, Chandrapur, Washim, Jalgaon, Dhule and Yavatmal districts have more than 60% of children who are anaemic.

It is clear from the above analysis that in Pune, Sangli and Sindhudur districts the intensity of nutritional problems among children with respect to at least three indicators of child malnutrition is relatively lower. On the other hand, Nandurbar, Yavatmal and Dhule are the districts where the problem is relatively severe with respect to at least three of the child malnutrition indicators.

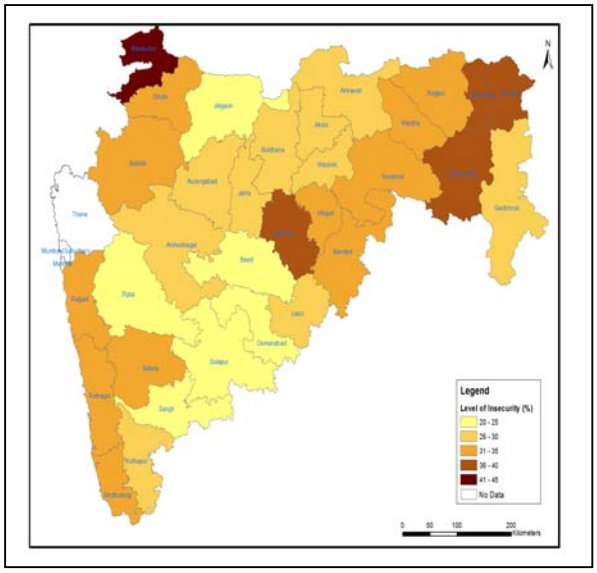
2.1.2 District-wise levels of malnutrition among women in rural Maharashtra.

**Table 2.6: Categorisation of districts by Level of Insecurity w.r.to Women Chronic Energy Deficiency (CED), Rural Maharashtra, 2015-16**

| Level of Insecurity | Name of Districts |
|---|---|
| Very Low | Solapur, Jalgaon, Beed, Pune, Osmanabad, Sangli |
| Low | Latur, Ahmednagar, Kolhapur, Akola, Aurangabad, Washim, Gadchiroli, Buldhana, Amravati, Jalna |
| Moderate | Yavatmal, Hingoli, Raigad, Wardha, Sindhudurg, Napur, Dhule, Nashik, Ratnagiri, Satara, Nanded |
| High | Bhandara, Chandrapur, Parbhani |
| Very High | Nandurbar |

Note: Percentage of children stunted in different categories are as follows: 20 -25% in very low; 26-30% in low; 31-35% in moderate; 36-40% in high and 41-45% in very high.
Source: Table 2.1

**Fig 2.9 Percentage of Women with CED**



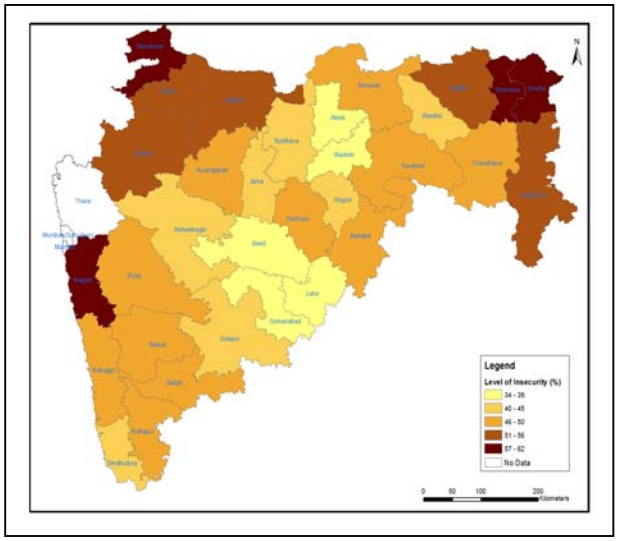

As regards nutritional problems among women, the percentage of women with CED was lowest in Solapur district at 20% and highest in Nandurbar district at 45%, in 2015-16. On an average, 30% of women were suffering from CED in rural Maharashtra and 16 districts recorded a higher percentage of women with CED than the state average. Solapur, Jalgaon, Beed, Pune, Osmanabad and Sangli are the districts with relatively lower percentage of women with CED while Nandurbar, Bhandara, Chandrapur and Parbhani districts were in the high insecurity levels.

**Table 2.7: Categorisation of districts by Level of Insecurity w.r.to Women Anaemia, Rural Maharashtra, 2015-16**

| Level of Insecurity | Name of Districts |
|---|---|
| Very Low | Beed, Osmanabad, Washim, Latur, Akola |
| Low | Solapur, Hingoli, Wardha, Jalna, Sindhudurg, Buldhana, Ahmednagar |
| Moderate | Amravati, Nanded, Parbhani, Kolhapur, Satara, Ratnagiri, Aurangabad, Yavatmal, Pune, Sangli, Chandrapur |
| High | Nagpur, Gadchiroli, Jalgaon, Nashik, Dhule |
| Very High | Gondia, Bhandara, Raigad, Nandurbar |

Note: Percentage of anaemic women in different categories are as follows: 34 -39% in very low; 40-45% in low; 46-50% in moderate; 51-56% in high and 57-62% in very high.
Source: Table 2.1

**Fig 2.10 Percentage of Women with Anaemia**




On an average, 48% of women in the reproductive age group in rural Maharashtra suffer from any form of anaemia. The intensity of the problem varies widely across the districts. Beed district has a minimum of 34% of women who are anaemic while Nandurbar has a maximum of 62%. 13 districts that fall in the moderate, high and very high insecurity categories have higher percentage of women with CED than the state average.

Beed and Osmanabad districts have relatively lower problems while Nandurbar has relatively higher problems, with respect to the two indicators of women malnutrition.

2.1.3 Overall assessment

On the whole, in rural Maharashtra, Sangli is the only district which has very low intensity of nutritional problems with respect to children and women whereas Nandurbar and Dhule are the two districts which have very high intensity of nutritional problems with respect to children and women[4].

[4] It is beyond the scope of this Report to examine the factors underlying the observed spatial patterns of nutritional problems in rural Maharashtra.

## 2.2 Average Consumption Levels

Some of the immediate factors influencing the malnutrition levels of women and children are related to the quantity and quality of food intake. To lead a healthy life, human beings need to consume a well balanced diet which includes various nutrients in proper proportions: cereals, roots and tubers (that provide energy and fibre to the body); protein rich foods like pulses, meat, fish, eggs and milk and milk products (that help to build muscles); sugars and oil (that give instant energy); and fruits and vegetables (that provide the vitamins and minerals required for many metabolic functions in the body).

Using, available secondary data on quantity of food intake, it is seen that the per capita average monthly intake of cereals in rural Maharashtra at 9.88kg, is lower than the recommended dietary intake (RDI) norm of 12kg/month/person[5]. Wheat is the major cereal consumed in rural Maharashtra. Average per capita consumption of pulses and milk in rural Maharashtra is much lower than the daily recommended allowance as well as the national average (**Table 2.8**). **Table 2.9** indicates that with respect to all food groups, the average consumption levels are lower than the RDI.

[5] Recommended Dietary Allowances are estimates of intakes of nutrients which individuals in a population group need to consume to ensure that the physiological needs of all subjects in that population are met.

**Table 2.8: Monthly per capita average consumption of selected commodities in rural areas, 2011-12**

| Commodities | Monthly Per capita average consumption of food items in rural areas | |
|---|---|---|
| | Maharashtra | India |
| Rice (kg) | 3.24 | 6.03 |
| Wheat (kg) | 4.31 | 4.29 |
| Total cereals | **9.88 (82%)** | **11.22 (94%)** |
| Arhar (Tur) –kg | 0.37 | 0.21 |
| Moong (green gram) -kg | 0.15 | 0.09 |
| Masur ( red lentil)-Kg | 0.06 | 0.11 |
| Urd (black gram ) kg | 0.07 | 0.08 |
| Gram split (kg) | 0.14 | 0.08 |
| Total pulses | **0.98 (41%)** | **0.78 (33%)** |
| Milk (litre) | 3.25 (36%) | 4.33 (48%) |
| Eggs (no.) | 1.77 (11.8%) | 1.94 (12.9%) |
| Fish (kg) | 0.09 | 0.27 |
| Goat meat /mutton (kg) | 0.07 | 0.05 |
| Chicken (kg) | 0.21 | 0.18 |

Note: 1) Recommended Dietary Intake (RDI) as per the norms of Indian Council of Medical Research (ICMR): Cereals = 12kg/capita/month; Pulses =2.4kg/capita/month; Milk =9kg/capita/month; Egg = 15 nos/capita/month
2) Figures in brackets provide the percentages with respect to RDI norms.
Source: GoI, 2014a; ICMR, 2011.

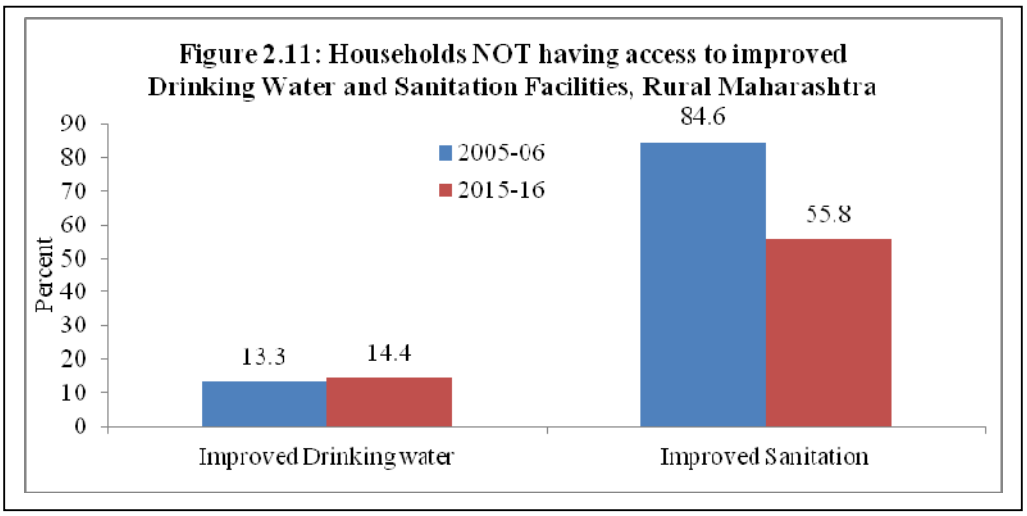
**Table 2.9: Average Consumption of Nutrients (CU/Day) in rural Maharashtra, 2011-12**

| Items | Consumption of nutrients (CU/day) | Consumption as a % of RDA |
|---|---|---|
| Protein (g) | 44.2 | 74 |
| Energy (Kcal) | 1587 | 58 |
| Calcium (mg) | 297 | 50 |
| Iron (mg) | 14.6 | 86 |
| Vit. A (µg) | 206 | 34 |
| Thiamin (mg) | 1.2 | 71 |
| Riboflavin (mg) | 0.7 | 41 |
| Niacin (mg) | 11.7 | 65 |
| Vitamin C (mg) | 27 | 68 |
| Dietary Folate (µg) | 124 | 62 |

Note: One consumption unit represents Recommended Dietary Allowance of energy for a sedentary man.
Source: NIN, 2012

## 2.3. Access to Water and Sanitation

Access to safe drinking water, clean and hygienic environment have a positive influence on nutrition status. **Fig 2.11** shows that over the decade 2005 to 2015, there is considerable improvement in the percentage of rural households that have access to sanitation.




However, in 2015 nearly 56 percent of rural households did not have access to improved sanitation facility while 14 percent of rural households did not have access to improved drinking water sources in Maharashtra.

Considering the important role of non-food factors such as safe drinking water, sanitation and hygienic environment in the absorption of food in human system, and therefore in the nutrition status, it is necessary that attention is paid to improve the access of these crucial household amenities in rural Maharashtra.

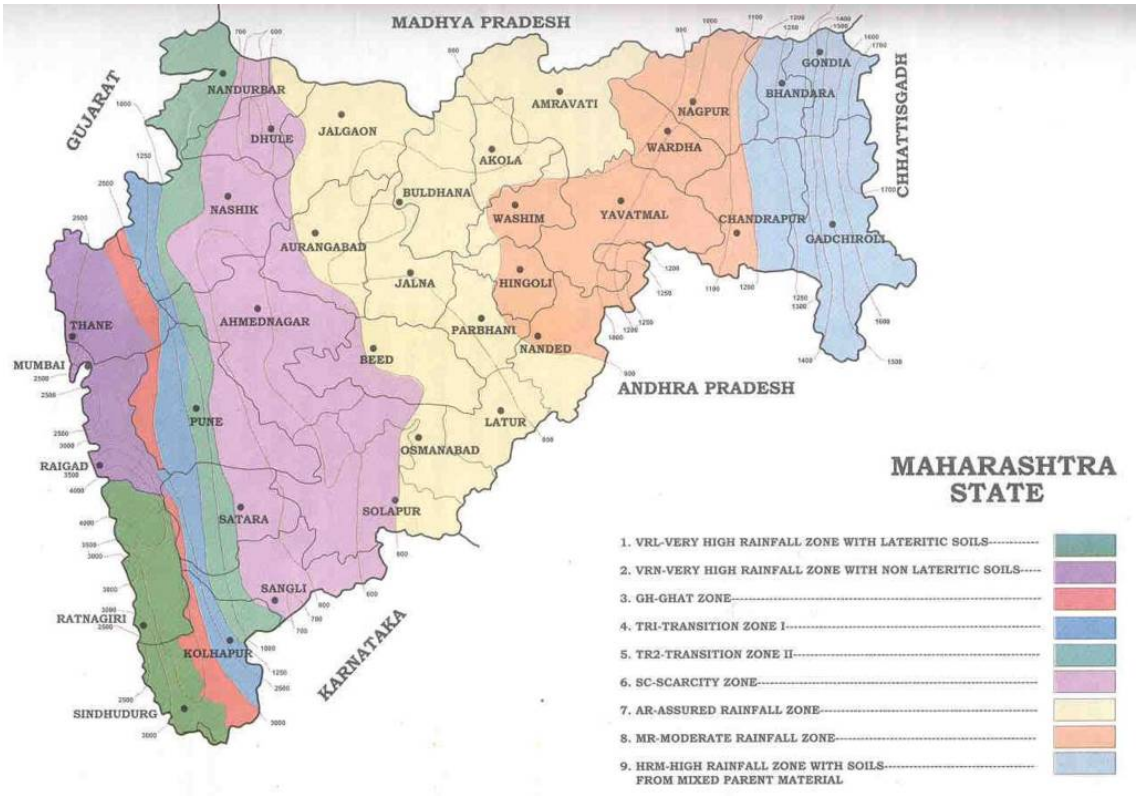
To sum up, despite improvements in nutritional status over the last decade, the extent of malnutrition among children and women continue to remain huge in rural Maharashtra; the average consumption of calorie, protein and micronutrients are below the recommended daily allowance; and the consumption of pulses by an average adult is just one fourth of the recommended dietary intake. It is in this context, that the promotion of 'Farming System for Nutrition' approach becomes important as a method of enhancing household production of a diversified basket of nutritious food leading to diversified diet of farm families. The observed spatial pattern in nutritional problems can help in prioritising interventions aimed at addressing the problem of malnutrition.

## Section 3:

## AGRICULTURAL PROFILE OF MAHARASHTRA

Maharashtra is divided into nine agro-climatic zones with distinct variation in rainfall, soil type and other climatic conditions **(Fig 3.1)**. The cropping pattern across the zones varies considerably.

**Figure 3.1: Agro-Climatic Zones of Maharashtra**



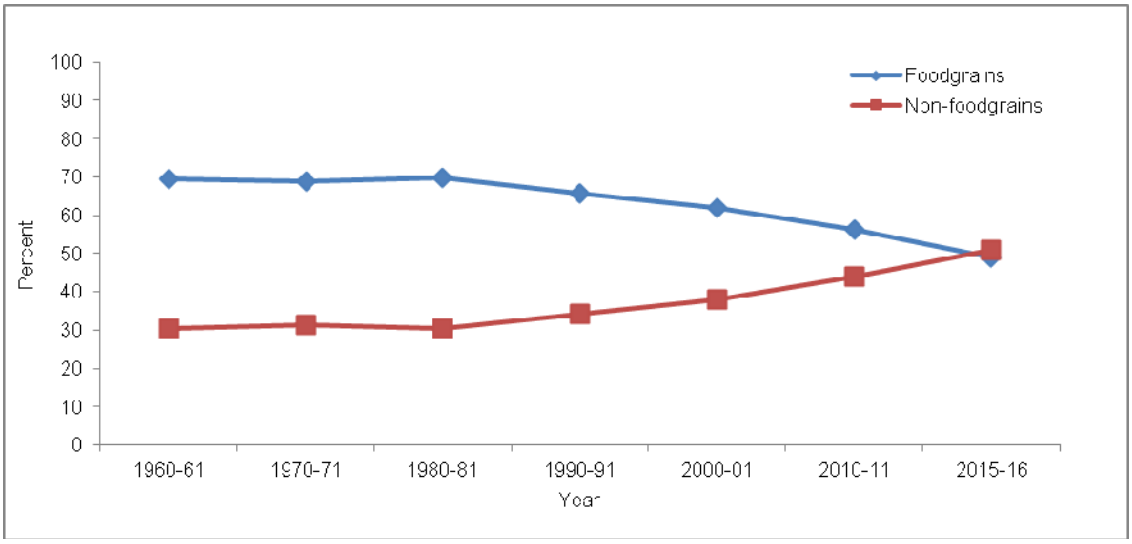

Source: GoM, 2015a

### 3.1 Agriculture

For the state as a whole, area cultivated with food grains has declined from nearly 70% in 1960-61 to 49% in 2015-16 (**Table 3.1, Fig 3.2**). There has been a drastic reduction in area under cultivation of nutri cereals -*jowar* and *bajra*- contributing to the overall decline in area under food grains. However, *jowar* remains the major food grain occupying 29% of total area under food grains, followed by paddy and gram (with 13%), and red gram (with 11%). Cotton, soyabean and sugarcane are the major non-foodgrain crops in Maharashtra. Area under soyabean has increased rapidly since 1990-91, accounting for 16% of Gross Cropped

Area (GCA) in 2015-16 while area under cotton has also increased and occupied 18% of GCA by 2015-16. Assured irrigation remains a major issue in Maharashtra with just about 18% of net sown area being irrigated in 2015-16.

**Figure 3.2: Area under Foodgrains and Non-foodgrains as a percentage of Gross Cropped Area, Maharashtra**




Source: GoM, 2018a

Maharashtra's contribution to total horticultural production in the country is significant. The state holds the second largest position with respect to share of total fruit production (11.2%) and fifth position with regard to total vegetable production (5.9%) in India (GoI, 2017a).

Production of major crops over the last six decades is presented in **Table 3.2**. Compound annual growth rates for these crops were calculated using Table 3.2. Over the 50 years since 1960-61, production of cereals has grown at an annual compound growth rate of 1.21%, production of pulses by 2.31% and total food grain production at the rate of 1.39%. Contributing to the slow growth of production of cereals is the decline in area as also low levels of yield. As noted by the Task Force on Agriculture Development in Maharashtra, a major concern in the state is low productivity in food grains as compared to the national average (GoM, 2015a).

**Table 3.1 Area under Major Crops in Maharashtra, 1960-61 to 2015-16 (Area in '000 ha)**

| Year | Paddy | Wheat | Jowar (Sorghum) | Bajra (Pearl millet) | All Cereals | Red Gram | Bengal Gram | Green Gram | Black Gram | Total Pulses | Total Food Grains | Soya bean | Cotton | Gross Cropped Area |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1960-61 | 1300 | 907 | 6284 | 1635 | 10606 | 530 | 402 | 0 | 0 | 2349 | 12955 | 0 | 2500 | 18605 |
| | 7.0 | 4.9 | 33.8 | 8.8 | 57.0 | 2.8 | 2.2 | 0.0 | 0.0 | 12.6 | 69.6 | 0.0 | 13.4 | 100.0 |
| 1970-71 | 1352 | 812 | 5703 | 2039 | 10320 | 627 | 310 | 0 | 0 | 2566 | 12886 | 0 | 2750 | 18736 |
| | 7.2 | 4.3 | 30.4 | 10.9 | 55.1 | 3.3 | 1.7 | 0.0 | 0.0 | 13.7 | 68.8 | 0.0 | 14.7 | 100.0 |
| 1980-81 | 1459 | 1063 | 6469 | 1534 | 10976 | 644 | 410 | 0 | 0 | 2715 | 13691 | 0 | 2550 | 19642 |
| | 7.4 | 5.4 | 32.9 | 7.8 | 55.9 | 3.3 | 2.1 | 0.0 | 0.0 | 13.8 | 69.7 | 0.0 | 13.0 | 100.0 |
| 1990-91 | 1597 | 867 | 6300 | 1940 | 11136 | 1004 | 668 | 0 | 0 | 3257 | 14393 | 201 | 2721 | 21859 |
| | 7.3 | 4.0 | 28.8 | 8.9 | 50.9 | 4.6 | 3.1 | 0.0 | 0.0 | 14.9 | 65.8 | 0.9 | 12.4 | 100.0 |
| 2000-01 | 1512 | 754 | 5094 | 1800 | 9824 | 1096 | 676 | 714 | 574 | 3557 | 13381 | 1142 | 3077 | 21619 |
| | 7.0 | 3.5 | 23.6 | 8.3 | 45.4 | 5.1 | 3.1 | 3.3 | 2.7 | 16.5 | 61.9 | 5.3 | 14.2 | 100.0 |
| 2010-11 | 1516 | 1307 | 4060 | 1035 | 8985 | 1302 | 1438 | 554 | 482 | 4038 | 13023 | 2729 | 3942 | 23175 |
| | 6.5 | 5.6 | 17.5 | 4.5 | 38.8 | 5.6 | 6.2 | 2.4 | 2.1 | 17.4 | 56.2 | 11.8 | 17.0 | 100.0 |
| 2015-16 | 1503 | 911 | 3217 | 801 | 7667 | 1237 | 1442 | 366 | 286 | 3544 | 11211 | 3702 | 4207 | 22863 |
| | 6.6 | 4.0 | 14.1 | 3.5 | 33.5 | 5.4 | 6.3 | 1.6 | 1.3 | 15.5 | 49.0 | 16.2 | 18.4 | 100.0 |

Note: Figures in shaded cells are percentage to row total
Source: GoM, 2018a

## Table 3.2: Production of Major Crops in Maharashtra, 1960-61 to 2015-16 (Production in '000 MT)

| Year | Rice | Wheat | Jowar (sorgum) | Pearl Millet (Bajra) | Other Cereals | All Cereals | Red Gram | Bengal Gram | Green Gram | Black Gram | Other Pulses | Total Pulses | Groundnut | Soyabean | Cotton* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1960-61 | 1369 | 401 | 4224 | 489 | 272 | 6755 | 468 | 134 | 0 | 0 | 387 | 989 | 800 | 0 | 1673 |
| 1970-71 | 1662 | 440 | 1557 | 824 | 254 | 4737 | 271 | 87 | 0 | 0 | 319 | 677 | 586 | 0 | 484 |
| 1980-81 | 2315 | 886 | 4409 | 697 | 340 | 8647 | 319 | 137 | 0 | 0 | 369 | 825 | 451 | 0 | 1224 |
| 1990-91 | 2344 | 909 | 5929 | 1115 | 443 | 10740 | 419 | 355 | 0 | 0 | 667 | 1441 | 979 | 190 | 1875 |
| 2000-01 | 1930 | 948 | 3988 | 1087 | 544 | 8497 | 660 | 351 | 244 | 205 | 177 | 1637 | 470 | 1266 | 1803 |
| 2010-11 | 2691 | 2301 | 3452 | 1123 | 2749 | 12317 | 976 | 1300 | 372 | 329 | 119 | 3096 | 470 | 4316 | 7473 |
| 2015-16 | 2593 | 981 | 1205 | 333 | 1783 | 6896 | 444 | 777 | 69 | 61 | 81 | 1432 | 334 | 1795 | 3914 |

Note: * - Production of cotton is in '000 bales (1 bale = 170 kg)
Source: GoM, 2018a

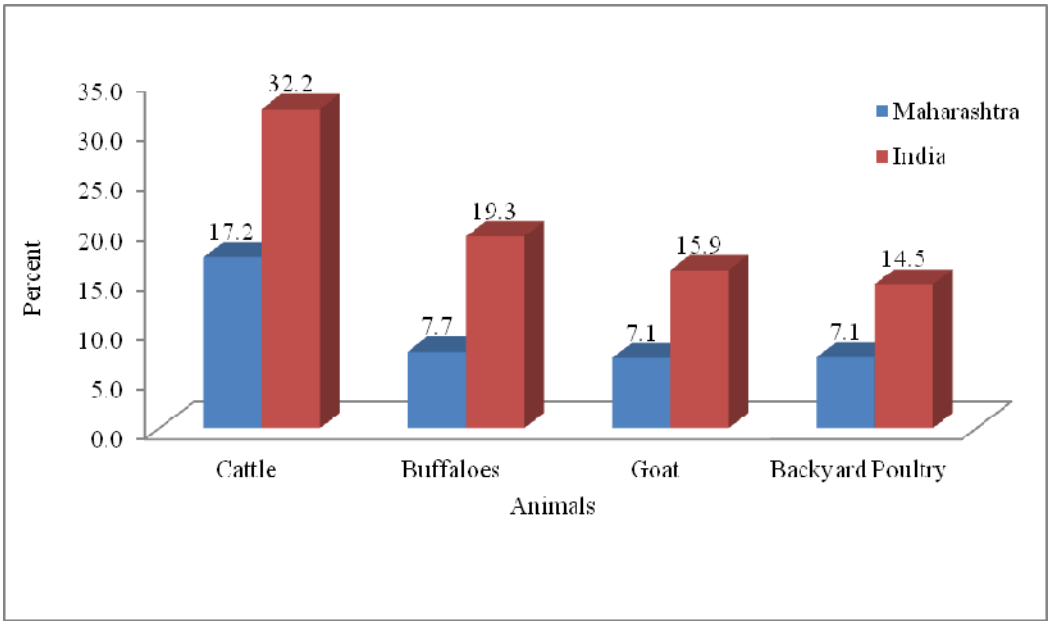
### 3.2 Livestock and Poultry

**Table 3.3: Livestock Population (in '000) of Maharashtra and India, 2012**

| Name | Maharashtra | India | % share of Maharashtra to India |
|---|---|---|---|
| Cattle | 15484.0 | 190904.1 | 8.1 |
| of which Crossbreed | 3650.9 | 39731.8 | 9.2 |
| Buffaloes | 5595.0 | 108702.1 | 5.1 |
| Sheep | 2580.4 | 65069.2 | 4.0 |
| Goat | 8435.3 | 135173.1 | 6.2 |
| Total Livestock | 32488.7 | 512057.3 | 6.3 |
| Total Poultry | 77794.6 | 729209.3 | 10.7 |

Source: GoI, 2017c

**Figure 3.3: Percentage of Households owning Animals/Poultry Birds in Rural Areas, 2012**




Source: GoI 2014b

Of the total 15484 thousand cattle, 23% were crossbred, in Maharashtra in 2012, while the corresponding percentage was 21% at all India level. According to Livestock Census, 2012,

percentage of rural households owning cattle, buffaloes, goats and backyard poultry are much lower in Maharashtra compared to the all India average (**Figure 3.3)** (GoI, 2014b).

An analysis of the distribution of cattle population across the 36 districts of Maharashtra, in 2012, shows that Ahmednagar has the largest share with 9.2 per cent while Raigarh has just about 1 per cent. Similarly, the distribution of buffalo population across districts is in the range of 1% to 11%, with Kolhapur district having the highest share of 11% of buffalo population and Raigarh with one per cent. Ahmednagar, Nashik, Pune, Solapur, Beed and Jalgaon districts have close to 4 per cent of cattle as well as buffalo population of the state. As a contrast, districts such as Washim, Hingoli and Raigarh are not livestock rearing areas and each of these districts account for only 1 per cent of the state's buffalo and cattle population.

The distribution of sheep population in Maharashtra is skewed in nature. Four districts, namely, Ahmednagar, Nashik, Pune and Satara account for half of the total sheep population in the state, in 2012. Ahmednagar and Nashik each has 14% of total sheep population of the state. For goat population, Ahmednagar has the maximum share of 9.4% followed by Solapur with 8.4%.

Ahmednagar had a maximum share of cattle, sheep and goat population in the state in 2012 whereas Pune is the only district that secured a position in top five districts for all four types of livestock population. Solapur and Nasik are the two districts that secure top five positions in three out of the four livestock groups (GoI, 2017c).

Per capita availability of egg and milk are lower in Maharashtra compared to the country as a whole (**Fig 3.4 & 3.5**). As the state also has a relatively lower incidence of households owning cattle and poultry, there is a need and scope to promote these livestock activities in rural areas, from the perspective of increasing the availability of nutritious food at the household level.

**Figure 3.4: Per Capita Availability of Eggs, Maharashtra (in Numbers/Annum)**

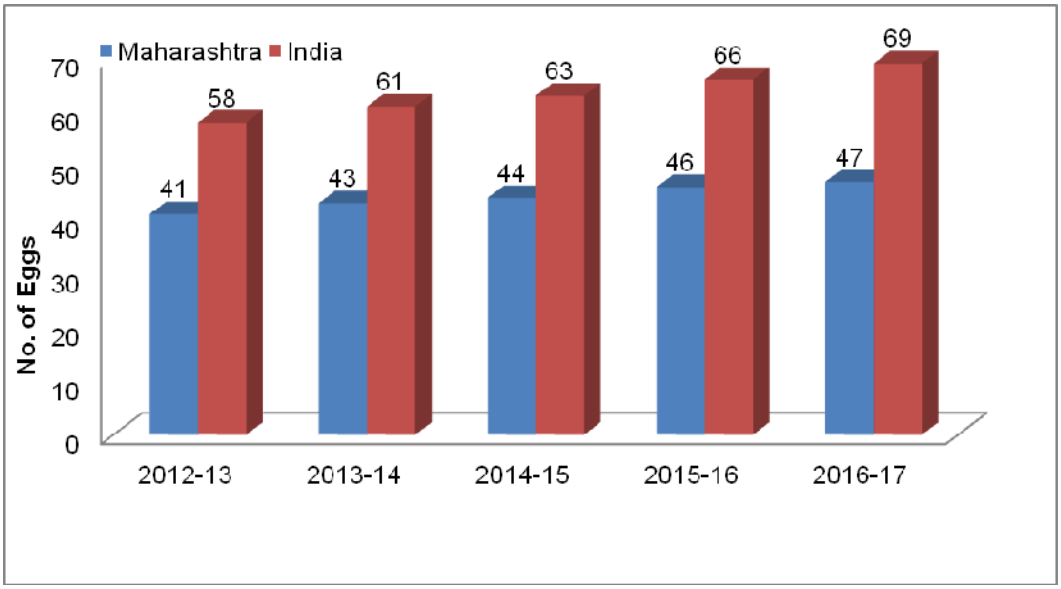
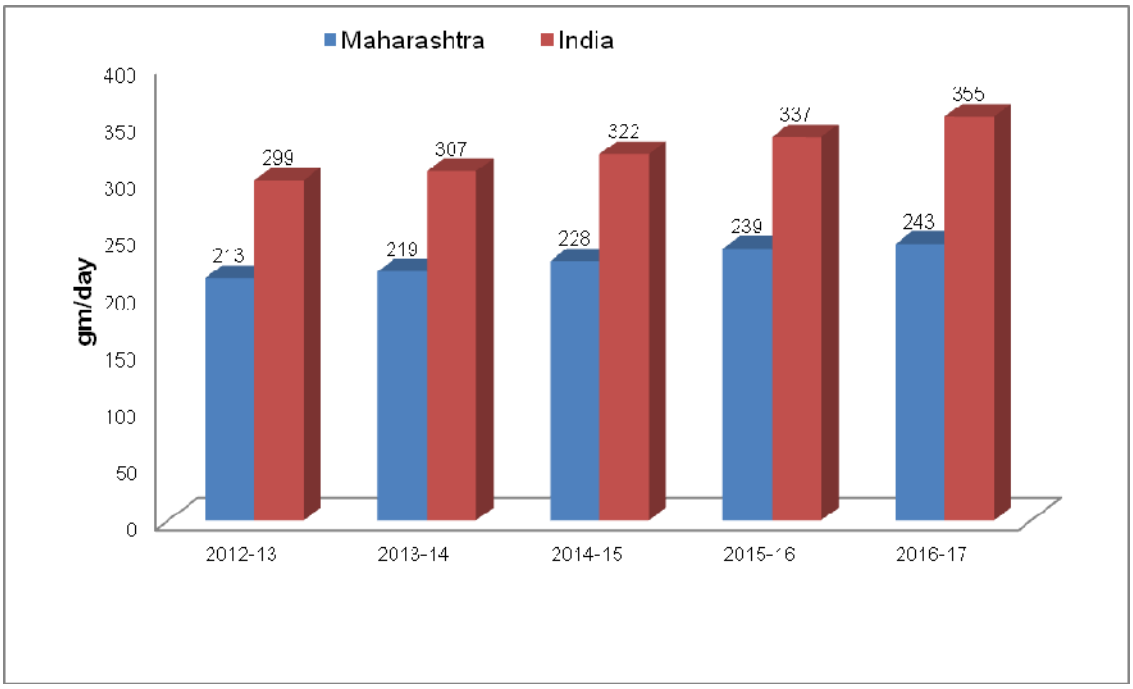



**Figure 3.5: Per Capita availability of Milk, Maharashtra (in gm/day)**




### 3.3 Consumption from Home grown Stock

Details of an analysis of consumption by producer households from home grown production based on unit level data from National Sample Survey Organisation (NSSO), are given in

**Table 3.4.** Of the total number of rural households in Maharashtra, 29 per cent are classified as self employed in agriculture whose major source of income is own cultivation of land, in 2011-12 (GoI, 2015b). Of these self employed households, a notable section uses their produce for home consumption: more than 40% of households consume nutri-cereals (jowar and bajra) and pulses; 37% of households consume milk; 18% of households consume vegetables. As regards the quantity that is consumed from home grown stock, it is seen that nearly 50% of jowar and bajra and 31% of all pulses that is consumed by producer households is from home grown production; and 55% of the total milk consumed is from home production.

**Table3.4: Consumption from Home Grown Stock in Rural Maharashtra, Self-employed Agricultural Households, 2011-12**

| Item | Percentage of Consumption from Home grown Stock | Percentage of Households consuming items from Home Produce |
|---|---|---|
| Rice | 26.1 | 21.96 |
| Wheat | 30.9 | 33.78 |
| Jowar | 53.1 | 48.02 |
| Bajra | 48.5 | 43.80 |
| Total Cereals | **33.0** | 62.51 |
| Red Gram | 42.6 | 36.68 |
| Bengal Gram | 26.8 | 24.91 |
| Green Gram | 30.3 | 25.39 |
| Black Gram | 46.4 | 33.88 |
| Total Pulses | **30.8** | 44.74 |
| Milk | 54.6 | 36.58 |
| Eggs | 21.5 | 11.86 |
| Vegetables | **5.5** | 18.08 |
| Fruits | **8.8** | 6.39 |

Source: GoI, 2015b

This analysis clearly indicates that farmers do retain a portion of their production for home consumption and there is scope to strengthen this tendency. For instance, with regard to

vegetables, fruits, pulses and eggs, there is scope to enhance the importance of home production for home consumption.

### 3.4 Agriculture Extension

To promote the FSN approach in rural Maharashtra, it would be necessary to strengthen the agricultural extension system. There exist a large number of vacancies in the agriculture extension services, particularly in the cadre of service providers below the taluka level as seen in Table 3.5. Addressing the issue of vacancies in sanctioned posts would be an important step towards reaching appropriate technical guidance to farmers to adopt a FSN approach. The NITI Aayog Task Force on Agriculture Development in Maharashtra has also emphasized the need to improve agriculture research and extension in the state.

**Table 3.5: Status of Manpower in Department of Agriculture, Maharashtra, March 2018**

| Sl. No: | Name of the Post | Number of Posts Sanctioned | Number of Posts filled-in | Number of Vacant Posts | |
|---|---|---|---|---|---|
| | | | | Nos. | % |
| 1. | Joint Director | 14 | 13 | 1 | 7.1 |
| 2. | District Superintendent Agriculture Officer | 46 | 45 | 1 | 2.2 |
| 3. | Sub Divisional Agriculture Officer | 202 | 174 | 28 | 13.9 |
| 4. | Taluk Agriculture Officer | 800 | 486 | 314 | 39.3 |
| 5. | Circle Agriculture Officer | 1652 | 987 | 665 | 40.3 |
| 6. | Agriculture Supervisor | 2726 | 2190 | 536 | 19.7 |
| 7. | Field Agriculture Assistant | 11599 | 9859 | 1740 | 15.0 |

Source: Collected from the Department of Agriculture, Govt. of Maharashtra

To sum up, an analysis of the agricultural and nutrition scenario of Maharashtra indicates that the persistent problem of malnutrition in Maharashtra has been accompanied by a decline in percentage of area under food grains. There is a pressing need to reorient agricultural policies that would improve farm level production diversity to influence household dietary diversity. Towards this some of the practices that can be promoted are as follows:

1. Different types of mixed farming systems with pulses and vegetables that is prevalent in various parts of Maharashtra, for e.g. vegetables intercropped with sugarcane in

Pune region; and growing of *moringa* on bunds in Dhule district can be promoted in other areas;

2. In Nandurbar district, farmers cultivate nutrient rich brown rice and white pigeon pea and there is scope to expand area under such nutri rich crops in other areas;
3. Jowar or Sorghum remains the most important food crop in the state and provides scope for promotion of Dhanasakthi, the iron rich biofortified variety of the crop.

## Section 4:
## BIOFORTIFICATION

Biofortification is increasingly been seen as one of the food based approaches to address the problem of malnutrition. Shetty (2009) opines:

"Micronutrient deficiencies are a problem that is much greater than hunger and is a prime example of the need to integrate both food and nutrition security. Sustainable food-based approaches to enable adequate consumption of micronutrients include dietary diversification and biofortification. Agriculture and agricultural biotechnology not only offer the opportunity of increasing crop yields, thereby increasing food security, but also have the potential to improve the micronutrient content of foods, thus contributing to the achievement of both food and nutrition security" (p.431).

According to WHO (2016), "Biofortification is the process by which the nutritional quality of food crops is improved through agronomic practices, conventional plant breeding, or modern biotechnology. Biofortification differs from conventional fortification in that biofortification aims to increase nutrient levels in crops during plant growth rather than through manual means during processing of the crops. Biofortification may therefore present a way to reach populations where supplementation and conventional fortification activities may be difficult to implement and/or limited".

A number of biofortified varieties of different crops have been developed by the Indian agriculture research system over the last two decades. Details of biofortified and stress tolerant crops that are developed and are suitable for Maharashtra are listed in **Table 4.1**.

**Table 4.1: BIOFORTIFIED CROPS SUITABLE FOR MAHARASHTRA**

| Sl. No: | Crops | Variety/ Hybrid | Characteristics | Developed / Released by | Seed Availability status[1] |
|---|---|---|---|---|---|
| 1. | **Wheat** | HI 8663 (Poshan) | **Biofortified Variety**<br>• Rich in beta-carotene 6.5 ppm (3.0-6.0 ppm), protein content 11.6 % (10%) & iron 47.0 ppm (35.0 – 40.0 ppm)<br>• Semi erect plant with medium size grains<br>• Yield per hectare: 4.55 tonne | Indian Agricultural Research Institute (IARI) Regional Station, Indore, Madhya Pradesh<br>Released by Central Variety Release Committee (CVRC) in 2007 | Certified seeds available |
| | | HW 1098<br>(Nilgiri Khapli) | **Biofortified Variety**<br>• Beta-carotene 3.7 ppm & protein content 16.5 %<br>• Bold size grains<br>• Yield per hectare: 4.55 tonne | IARI, Regional Station, Wellington,<br>Tamil Nadu<br>Released in 2015 | Breeder seeds available at IARI, Wellington |

| | | | | | |
|---|---|---|---|---|---|
| 2. | **Quality ProteinMaize** | Pusa Vivek QPM 9 Improved | **Biofortified (Hybrid)**<br>• High pro-vitamin-A<br>8.15 ppm (1.0 - 2.0 ppm), lysine 2.67%<br>(1.5 - 2.0 %) & tryptophan 0.74% (0.3- 0.4%)<br>• Yield per hectare: 5.92 tonne<br>• Duration: 83 days | IARI, New Delhi.<br>Released in 2017 | Breeder seeds available at IARI, New Delhi |
| | | Pusa HM 8 Improved | **Biofortified (Hybrid)**<br>• Rich in tryptophan 1.06 % and lysine 4.18 %<br>• Yield per hectare: 6.26 tonne<br>• Duration: 95 days | IARI, New Delhi<br>Released in 2017 | Breeder seeds available at IARI, New Delhi |
| | | HQPM-1 | **Biofortified (Hybrid)** | Chaudhary Charan Singh Haryana Agricultural University (CCS-HAU), Hisar | Certified seeds available with National Seeds Corporation Limited |

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|---|---|---|---|---|---|
| | | | • Quality protein maize hybrid possess lysine and tryptophan double than conventional maize<br>• Yellow dent grains<br>• Yield per hectare: 6.2 tonne<br>• Duration: Long duration | Released in 2007 | |
| | | HQPM-4 | **Biofortified (Hybrid)**<br>• Lysine and tryptophan double than conventional maize<br>• Orange flint grains<br>• Yield per hectare: 5.4 tonne<br>• Duration: Long duration | CCS-HAU, Hisar<br>Released in 2010 | Certified seeds available |
| | | HQPM-5 | **Biofortified (Hybrid)** | CCS-HAU, Hisar | Certified seeds available with National Seeds Corporation Limited |

| | | | | | |
|---|---|---|---|---|---|
| | | | • Lysine and tryptophan double than conventional maize<br>• Orange flint grains<br>• Yield per hectare: 5.8 tonne<br>• Duration: Long duration | Released in 2007 | |
| | | HQPM-7 | **Biofortified (Hybrid)**<br>• Posses lysine and tryptophan double than conventional maize<br>• Orange flint grains<br>• Yield per hectare: 7.2 tonne<br>• Duration: Long duration | CCS-HAU, Hisar<br>Released in 2008 | Information not available |
| 3. | **Pearl Millet** | Dhanashakti | **Biofortified Variety** | International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), Hyderabad | Truthfully Labelled (TFL) seeds available with Nirmal Seeds Private Limited, Maharashtra |

| | | | | | |
|---|---|---|---|---|---|
| | | (ICTP 8203 Fe) | • Rich in iron 71.0 ppm (45.0 -50.0 ppm) & zinc 40.0 ppm (30.0 -35.0 pm)<br>• Yield per hectare: 2.2 tonne | and Mahatma Phule Krishi Vidyapeeth, Rahuri<br>Released in 2013 | |
| | | ICMH 1201<br>(Shakti 1201) | **Biofortified (Hybrid)**<br>• Rich in iron 75.0 ppm and zinc 40.0 ppm<br>• Yield per hectare: 30% more than that of Dhanasakthi | ICRISAT, Hyderabad<br>Released in 2014 | TFL seeds available with Shakti Vardhak Seed Company, Haryana |
| | | HHB 299 | **Biofortified (Hybrid)**<br>• Contains high iron 73.0 ppm and zinc 41.0 ppm<br>• Yield per hectare: 3.27 tonne | CCS-HAU, Hisar –ICRISAT under All India Coordinated Research Project (AICRP) on Pearl Millet<br>Released in 2017 | Breeder and TFL seeds available at IARI, New Delhi |

| | | | | | |
|---|---|---|---|---|---|
| | | | • Duration: 81 days<br>• Recommended for kharif season | | |
| | | AHB 1200 | **Biofortified (Hybrid)**<br>• Rich in iron content 73.0 ppm<br>• Yield per hectare: 3.2 tonne<br>• Duration: 78 days<br>• Recommended for kharif season | Vasantrao Naik Marathwada Krishi Vidyapeeth (VNMKV), Parbhani - ICRISAT under AICRP on Pearl Millet<br>Released in 2017 | Breeder and TFL seeds available at IARI, New Delhi |
| 4. | **Foxtail Millet** | Suryanandi (SiA 3088) | **Biofortified Variety**<br>• High iron content 129.0 ppm (27.19 ppm)<br>• Non-lodging type. | Regional Agriculture Research Station (RARS), Nandyal<br>Released in 2012 | Breeder and TFL seeds available with RARS, Nandyal |

| | | | | | |
|---|---|---|---|---|---|
| | | | • Yield per hectare: 2.0 - 2.5 tonne<br>• Duration: 70 -75 days | | |
| 5. | **Little Millet** | Tarini (OLM 203) | **Biofortified Variety**<br>• High iron content 51.0 ppm (32.71 ppm)<br>• Yield per hectare: 1.0 - 1.1 tonne<br>• Duration: 105 - 110 days | Odisha University of Agriculture and Technology (OUAT), Bhubaneswar<br>Released in 2001 | Information not available |

Note: 1. Figures in brackets in column 4 refer to the nutrient content in conventional crop varieties
Source: Largely drawn from Yadava D.K (2018) and various research institutions.

Given the availability of suitable biofortified varieties, particularly in pearl millet and wheat, there is scope to promote these varieties among farmers through appropriate policies. Needless to add, promoting these varieties will have to be based on detailed field based studies on their efficacy.

# Section 5:

## POLICY LANDSCAPE ANALYSIS OF MAHARASHTRA

This section presents a desk review of the current landscape of state and central government policies that foster nutrition-sensitive agriculture by both promoting farming systems for nutrition and improving food and non-food factors that enhance the availability of nutrition-rich foods in rural households and markets in Maharashtra. The analysis framework recognizes policy emphasis on each of four direct or core domains of farming system for nutrition and three enabling or non-core domains[6]. A description of the policies considered within each domain is provided in **Table 5.1.** In order to identify areas for improvement, we review government documentation on both the policy agenda setting and the policy adoption stages of the policymaking process (Sutton, 1999).

The review of policy agenda analyses farming system for nutrition related visions and goals identified formally by the state government in long-term policy documents. The review of policy adoption collates farming system for nutrition related schemes and programmes that have been adopted by the state government through the allocation of funds in the state budget. The landscape analysis conducted at both stages enables us to identify whether policy gaps are arising from lack of recognition of policy issues or solutions, or a lack of implementation of policy solutions.

[6] Policies to improve access to safe drinking water and sanitation have not been covered in this analysis. However, the status with respect to these factors has been discussed in Section 2.

**Table 5.1: Farming System for Nutrition policy domains**

| Domain | Description |
|---|---|
| 1. Agricultural Production Diversity | Policies that encourage integrated farming systems and farm-level diversity combining agriculture, horticulture, animal husbandry and fisheries with the intention of enhance the availability of nutrients within a household or local market. |
| 2. Agricultural Production | Policies that improve the production and productivity to enhance the availability of nutrient-rich food in the regional market |
| 3. Biofortification | Policies that encourage the production of nutrient-dense biofortified varieties for the regional market |
| 4. Agricultural Value Chains | Policies that support the production of nutrient-rich crops by creating handling, storage, processing infrastructure, and avenues for marketing and value addition to enhance availability in the local market |
| 5. Nutrition-education and behaviour change | Policies that improve the demand for nutrient-rich crops through awareness creation and behaviour change communication |
| 6. Women's empowerment | Policies that improve the demand for nutrient-rich crops by empowering women to exercise their choice in household agriculture and nutrition |
| 7. Natural resource management | Policies that support the production of nutrient-rich crops by conserving natural resources |

Though the state government has accorded great importance to agriculture and has undertaken several initiatives to improve productivity and farmer incomes while conserving resources, there is ample potential to integrate nutrition objectives into agricultural policy, with the aim of reducing Maharashtra's malnutrition burden while also encouraging the production of diverse, risk tolerant, high-value and marketable crop and animal products. The scope available in the policies to enhance the nutrition focus is discussed below.

### 5.1 Review of Policy Agenda and Policy Adoption

The first step in the policy-making process is "agenda-setting" or the recognition of a problem or space where policy can make a positive difference. Once a problem is recognized by policymakers and policy influencers, the scope arises for democratic deliberation to 'adoption' of a policy solution (Jann and Wegrich, 2007). To understand whether the state government has recognized nutrition as a policy problem and the potential for agriculture to provide a policy solution, we review progress made in both the 'agenda-setting' and 'adoption' stages.

We analyze prominent 'agenda documents' - long term mission or vision statements or polices adopted by the Government of Maharashtra for indications that the various domains of farming system for nutrition form a part of the state government's agenda. The documents analysed include the State Vision 2030 (2017a), the Recommendations of the State Level Task Force on Agricultural Development (2015), Rajmata Jijau Mother-Child Health and Nutrition Mission Multisectoral Action Plan, Maternal, Infant and Young Child Nutrition (MIYCN) Policy (2015), and Recommendations of Malnutrition Monitoring Committee (2012). In addition, the State Organic Policy (2016) and the Agro Industrial Policy (2010) were also reviewed. To analyze "policy adoption" status, schemes included in the annual budgets for the state government for 2018-19, the management information system (MIS) of the State Government Department of Economics and Statistics and relevant department websites were referred to.

The recently adopted Maharashtra State Vision 2030 document sets out the broad agenda for the economic and social development for the state. The State Vision document as well as the report of the task force for agricultural development constituted by NITI Aayog take stock of the status and challenges in agriculture policy in Maharashtra and provide several recommendations. An agriculture policy for the state is not currently available in the public domain, however focused policies are outlined in the Organic Farming and Agro Industry policy documents. Maharashtra's Rajmata Jijau Mother-Child Health and Nutrition Mission (RJMCHNM), has been guiding the policy action on malnutrition, especially in women of reproductive age and young children since 2005. It was one of the first nutrition missions in the country and has set an example for other states by adopting a multi-sectoral approach to combating childhood malnutrition focusing on the critical 1000 day window from birth to 2 years within which a child attains most of its developmental potential. The state's Maternal, Infant and Young Child Nutrition (MIYCN) policy and malnutrition monitoring committee also lay down specific strategies to improve nutritional indicators in the state, especially in tribal areas and urban slums. The State Vision 2030 document aims to reduce the incidence of malnutrition and ensure access to sufficient and nutritious food for all. It aims to undertake both nutrition-specific and nutrition-sensitive initiatives to improve its current status.

As a next step after "agenda-setting" in the policy-making process we analyze the status of policy formulation and "adoption". A core element of policy adoption is the specification of

program details and the allocation of resources, including human and physical capital (Jann and Wegrich, 2007). In the absence of a publicly available comprehensive record of adopted policies, we define the set of adopted policies as those that have received a budget allocation in the state budget. For Maharashtra, we include the most recently presented state budget, for 2018-19, as well as special schemes if any that find mention in the state government MIS; and all policies relating to the 4 "*core*" domains and nutrition-sensitive policies in the 3 "*non-core*" domains of "*farming system for nutrition*", from the budgets of the departments of agriculture, co-operation and farmer's welfare, animal husbandry, fisheries, women and child development, rural development, health, medical and family welfare, backward classes and minority welfare.

The agenda and policy documents together define the scope of priorities recognized by the state government and action taken thus far in promoting a "*farming system for nutrition"* a brief description of the government agenda categorized according the key aspects identified in Table 5.1 is summarized below. The full list of agenda statements and policies points can be found in Appendix 1 and 2 respectively.

1. ***On-Farm Production Diversity:***

   **Policy Agenda:** The State Vision 2030 grants ample importance to integrated farming systems and the promotion of land and watershed development, crop husbandry, dairy development, fisheries, apiculture, sheep-rearing etc. These strategies are recommended for improving incomes sustainably and mitigating risk of crop failure. The model is specifically recommended as part of a "dryland mission" to improve productivity in drought-prone areas of the state. The document also crucially points out the need for planning farming systems that are demand-driven and considering the village as a unit of development in the nutrition side, the RJMCHNM recommends promotion of kitchen gardens to improve the local production of fruits and vegetables and the inclusion of fresh local foods in supplementary nutrition given under the ICDS. The MIYCN policy stresses on the need to empower extension workers to support communities in producing and consuming crops and livestock of higher quality.

**Policy Adoption:** Mixed cropping and inter-cropping are recommended systems under the major central resource conservation programs such as the IWMP and NMSA as well as under sub-schemes of the NFSM and RKVY. Rural backyard poultry is promoted under the National Livestock Mission. Other than these, certain initiatives under the *Mahila Kisan Sashaktikaran Paryojana* (MKSP) and the Maharashtra Project on Climate Resilient Agriculture (PoCRA) provide knowledge and support on integrated farming systems for sustainable income generation. The state government has also implemented a scheme to promote kitchen gardens in tribal areas.

**Scope for further action:** In agenda documents, although the need for integrated farming systems has been adequately recognized, the nutritional benefits of such a farming system have not been highlighted. Providing integrated systems with a nutritional objective can ensure that these become "farming system for nutrition", yielding a balanced set of nutrients while also providing higher incomes and climate resilience. Demand-driven planning guidelines can specify that the household's or community's nutritional needs are taken into account when identifying appropriate systems. A stand-alone state-wide policy to promote integrated farming as recommended by the State Vision can be implemented especially in areas with poor nutritional indicators. Training extension workers on nutrition and disseminating knowledge of nutrition-sensitive agriculture as recommended by the MIYCN policy will strengthen any integrated farming policy. Inter-departmental convergence across agriculture, horticulture, animal husbandry and fisheries departments is essential for policy action in this area.

2. ***Agricultural production:***

**Policy Agenda:** Although Maharashtra is a major producer of sorghum, pulses and oilseeds, yields have fluctuated from year to year. Among the measures recommended for improving agricultural production and reducing cost of cultivation in the state are promotion of quality seed production and need-based use of fertilizers and pesticides, encouraging mechanization and early warning systems for pests and diseases. The government also seeks to bring at least 10% of the cropped area under low external input sustainable agriculture or organic farming. To equip farmers with better

agricultural advisory and improve technology adoption, several measures are recommended. The state aims to leverage private participation (through public-private partnerships) in setting up common service centres to provide weather and market-related information and complete end-to-end projects involving technology dissemination, farmer group participation, input supply and storage. The State Vision 2030 also seeks to improve the flow of technology from universities to the farmer through farmer field schools and improved use of mobile and cyber extension. The importance of improving productivity of principal crops, horticulture, floriculture, livestock and fisheries is duly recognized. Initiatives to improve breeding, availability of nutritive fodder, veterinary care, conservation of indigenous breeds and doubling fish farm productivity are recommended.

**Policy Adoption:** National and state programs focused on promoting best practices in seed, nutrient management and pest/disease protection are in place. These include major central schemes such as the NFSM, RKVY, MIDH and NMAET. State plan schemes further extend subsidy on fertilizers, promote mechanization on custom-hiring basis, support plant protection through a Crop Pest Surveillance and Advisory Project (CROPSAP) and provide extension. As recommended in the government documents, initiatives to improve seed production have been undertaken. Organic production is promoted by several central schemes (e.g. PKVY and NMSA) and state schemes outlined in the State Organic Farming Policy. Responding to unique challenges in the state, provisions have been made for improving dryland farming in the state and providing economic assistance specifically to farmers from Vidarbha. Animal husbandry department schemes such as the Navinya Purna Yojana, State Cattle Development Scheme, Special Component Plan and the Marathwada package supply subsidised cattle to farmers. Initiatives to support development of sheep, goat, ruminants and small animals have been taken. The fisheries department has undertaken modernization efforts.

**Scope for further action:** While there are centrally sponsored schemes in place to improve production of millets and legumes, there exists scope for the state government to further develop extension, subsidy and research focused on enhancing climate resilience of these cropping systems. This would serve to ensure a consistent

supply of nutritious staples such as sorghum and pigeonpea across the state and prevent extensive diversification into non-food crops. Several schemes to improve small and large livestock production exist but policy can lay more emphasis on fruits and vegetables and fisheries taking into consideration the recommendations made by the State Vision document and Task Force on Agriculture. Importantly, the comprehensive suggestions made by the agenda documents to improve the state extension system need to be implemented. Leveraging agricultural universities and pursuing Public Private Partnership (PPP) models to reach farmers across the state and provide them access to knowledge and inputs can serve to modernize and stabilize agricultural production. These extension channels can also promote nutrition-sensitive-agriculture.

***3. Biofortification:***

**Policy Agenda:** The benefits and importance of biofortified varieties of crops in combating malnutrition have not been explicitly recognized in the state's prominent agenda documents.

**Policy Adoption:** No major state schemes have been put in place yet to promote biofortified varieties.

**Scope for further action:** Maharashtra was one of the first states in the country where biofortified varieties were introduced commercially. Iron-rich pearl millet (marketed as Dhanshakti) and high-iron high-zinc sorghum varieties developed by research institutions such as ICRISAT and Harvest Plus were promoted and tested in Maharashtra in 2013. There is ample scope for Maharashtra to set an example to other states by adopting progressive agriculture-nutrition policies and using biofortified crops in the fight against malnutrition. The state should set a road map for the end-to-end promotion of biofortified varieties and draw on the learnings of the pilot projects conducted thus far.

***4. Agricultural Value Chains:***

**Policy Agenda:** As an industrialized state with large commercial potential, Maharashtra has set itself impressive goals for agri-business, market linkages and

institutional improvements. Thrust has been given to setting up of farmer producer organizations and crop associations. The state cleverly envisages private participation and private-public partnerships in supporting farmer organizations, developing integrated value chains, setting up market infrastructure and providing market and weather knowledge through Common Service Centers. It also seeks to promote private participation in contract farming through which farmers can access inputs, extension, post-harvest management and storage support, and achieve higher prices especially in organic or minimal residue contracts. Several reforms to market infrastructure have been suggested – the task force on agricultural development calls for encouraging MSMEs run by educated youth or farmer groups to produce crucial inputs like bio-fertilizers, bio-pesticides, small storage structures and processing units depending on local cropping pattern and decentralized storage structures in each village that are linked with banking institutions and spot exchanges while the State Vision suggests a "godown receipt scheme" to prevent distress sale. The role of PACS and APMCs are to be revamped and simple strategies to promote direct marketing, e-marketing and set up a hierarchy of markets from the village to terminal markets. The State Vision and Agro-industry Policy also provide impetus to the development of agri-industry clusters, food parks and seek to provide infrastructural and legal support to improve agricultural exports.

**Policy Adoption:** Thus far only some of the recommended strategies have been implemented as stand-alone schemes. The state plan provides for the promotion of group farming and entrepreneurship. There is also a policy to promote cold chain development and agro-processing. Among the end-to-end projects are three large PPPs conducted in association with prominent international development organizations – the Maharashtra Project on Climate Resilient Agriculture with the World Bank beginning in 2018 aims to develop smallholder-inclusive value chains and is said to impact 25 million farmers in the state, the IFAD funded Convergence of Agri-Interventions in Maharashtra Project started in 2009 helps farmer groups become involved in processing and quality improvement and the ADB-funded Agri-business Infrastructure Development Project improves two horticulture based integrated value chains. End-to-end programs undertaken by the state are the provision for stability of dryland farming scheme and the state organic farming policy. The animal husbandry

and fisheries departments have specialized initiatives to strengthen cooperatives and improve the production of value added products such as dairy, wool etc.

**Scope for further action:** The agenda documents lay down several strategies for the improvement of agricultural value chains in Maharashtra, leveraging its industrial strength and access to high-value markets. However, rapid policy action is required to implement these strategies and transfer the benefits to smallholder farmers. Measures suggested especially for improving local storage, such as the "godown receipt" scheme, and promoting rural entrepreneurship in processing have the potential to increase farmer incomes and benefit rural markets. Market reforms, while initiated, need to be scaled up to benefit more farmers, increase the volume of trade through direct marketing channels and ensure supply to areas with low availability. Agricultural value chains need to be made nutrition-sensitive by giving priority to nutritious crops such as millets, pulses, fruits and vegetables. Entrepreneurs can be incentivized to supply fresh and processed produce to rural markets. Decentralized storage and market infrastructure at the village-level, as recommended by the task force on agricultural development, can further improve supply in rural areas.

5. ***Nutrition Education and Behaviour Change:***

**Policy Agenda:** As mentioned earlier, Maharashtra was the first state to set up a nutrition mission in the country in 2005. Referred to as the Rajmata Jijau Mother Child Health and Nutrition Mission, this mission in its first and second phases has provided several recommendations for reducing maternal and childhood malnutrition especially in the first 1000 day window after birth. The mission has recommended several measures to strength the ICDS system such as setting up anganwadis, Village Development Centers (VDCs) and mother-child days to provide nutrition education to mothers and care-givers, including information on diet diversity and the need to incorporate macro and micro nutrients in daily diet. The MIYCN policy recommends a holistic nutrition and food fortification policy to combat malnutrition and training of agricultural extension workers to provide information on the linkages between agriculture and nutrition and inclusion of nutritious crops in diet.

**Policy Adoption:** The ICDS, the flagship scheme of the Women and Child Development department, is the largest scheme providing nutrition education in the state. The state has already implemented VDCs and taken steps to improve the reach of anganwadi centres in an attempt to strengthen the ICDS. Other central schemes targeted at girls and mothers such as the SABLA scheme, Kishori Shakti Yojana, Mattritva Vandana Yojana also provide nutrition education, among other activities.

**Scope for further action:** Initiatives can be taken to develop state-specific guidelines for the nutrition education provided under prominent central schemes. These guidelines should incorporate information on local nutrition deficiencies and recommend the inclusion of locally available nutritious grains, pulses, fruits, vegetables and animal products in the daily diet. As recommended under the MIYCN policy, agricultural extension staff can also be trained to provide information on the nutritive value of crops and the benefits of a diversified diet while recommending cropping patterns. Further, nutrition education and BCC programs can be targeted not just at mothers and young children but all decision-makers in the household.

6. ***Women's Empowerment:***

**Policy Agenda:** Maharastra's State Vision 2030 recognizes women as equal partners in development of the state. To incorporate gender-inclusiveness at all levels, it has recommended gender-responsive budgeting for the state. Strategies that have been recommended for empowering women socially and economically, include education, skill development and micro-livelihood programs. The government seeks to involve industry through CSR or otherwise in improving status of women, providing access to childcare and reducing malnutrition. The RJMCHNM multi-sectoral action plan also calls for "kad dhanya" scheme to provide iron and protein rich natural supplements (e.g. gur, pulses and groundnuts) to pregnant and lactating mothers to ensure their nutrition security.

**Policy Adoption:** The state government has strong interventions focused on providing subsidized quality education to women – including the *Mazi Kanya Bhagyashree* and *Peedit Mahila* and *Balak Manodhairya Yojana*. Skill development and micro-livelihood programs are provided through the Mahila Arthik Vikas

Mahamandal. A state mission authority for women's empowerment has also been constituted. Major central schemes for the empowerment of women and prevention of domestic violence such as National Mission for Empowerment of Women, One Stop Centre, State Commission for Women, Gender Cell, Swadhar Greh Yojana etc., are in place.

**Scope for further action:** The State agenda for agriculture can give more recognition to the important role played by women in agriculture and nutrition and the need for gender-inclusive agricultural policy. Accordingly, there is scope for gender sensitization of existing schemes in agricultural technology and value chains. Programs like MKSP can be continued to achieve convergence between agriculture, nutrition and gender goals of the state by taking initiatives to provide relevant extension to women, encourage women's groups to cultivate nutritious crops and participate in value addition or marketing. Women are uniquely placed to receive and trigger change towards nutrition-sensitive agriculture concepts.

***7. Natural Resource Management:***

**Policy Agenda:** Recognizing the state's climatic variability and vulnerability to drought, the state agenda recognizes the need to implement initiatives in climate change management – e.g. weather based crop advisories, pest management, protected cultivation and crop diversification. Soil health programs are emphasised particularly to conserve fertility through organic, low input and minimal residue agriculture and in-situ moisture conservation. Given the state's low irrigation potential, increase in water productivity is targeted through improved irrigation and coverage of watershed and farm ponds and participatory irrigation management.

**Policy Adoption:** The most important irrigation scheme undertaken by the state government is the *Jalyukt Shivar Abhiyaan* which aims to make the state drought-free by 2019 and involves several strategies to develop new irrigation structures and improve existing ones and also promotes participatory irrigation management. The state also runs a micro-irrigation program to meet gaps in irrigation potential. Irrigation schemes of the central government such as IWMP, RKVY and *Pradhan Mantri Krishi Sinchayi Yojana /Har Khet ko Pani* are in place. The state organic

farming policy and central organic farming and sustainable agriculture schemes also contribute to natural resource conservation. The World Bank-funded PoCRA is promoting climate resilient cropping systems that rely on few inputs and restore soil health.

**Scope for further action:** Farming system for nutrition have the potential to be climate resilient and less-resource intensive while at the same meeting the nutritional needs of the household and community. Mixed cropping or inter-cropping of legumes and grains, food crops and horticulture, food crops and fish, and using natural biomass from livestock waste are practices that are both sustainable and nutrition sensitive. These strategies can be incorporated under existing central and state resource conservation schemes such as IWMP, RKVY, *Jalyukt Shiv*ar *Abhiyaan* and PoCRA.

## Section 6:

## RECOMMENDATIONS FOR PROMOTING FARMING SYSTEM FOR NUTRITION IN MAHARASHTRA

Maharashtra has formulated a State Vision for 2030 that spells out 'Ensure sufficient and nutritious food for all at an affordable cost' as a goal. Incidence of malnutrition, particularly in tribal areas, is seen as a major challenge. To this end, Maharashtra's Maternal Infant Young Child Nutrition Policy has envisioned a role for the agriculture department in combating malnutrition and adequately recognizes the importance of promoting the cultivation of diverse crops and educating the public on the links between diet and nutrition. However, while the State Vision calls for need-based integrated farming systems to improve climate resilience and resource conservation, nutrition has not yet been recognised as a goal for agriculture and allied activities. Significant steps have been taken to reform agricultural marketing, improve climate resilience and water conservation, promote animal husbandry, and improve livelihood opportunities for women. A comprehensive agriculture policy for the state, when adopted, can achieve synergy between these initiatives and nutritional objectives. Some specific recommendations for promoting farming system for nutrition approach in Maharashtra are as follows:

1. **Improved nutrition must be placed as a key agenda in promoting Integrated Farming Systems (IFS).** The integrated farming system approach through land and watershed development, crop husbandry, dairy development, fisheries, apiculture, sericulture, etc has already been recommended for sustainable income generation, especially in areas with water scarcity. This approach can be modified to include the nutrition dimension, say, to address the nutritional deficiencies prevalent in a specific region. Steps can be taken by the government to implement this message in extension efforts and livelihoods programmes. Convergence between relevant departments – agriculture, horticulture, animal husbandry and fisheries- is needed to ensure ease of access to relevant inputs and knowledge.
2. **Kitchen garden initiative must be scaled up**. The state is already implementing a programme to set up kitchen gardens in tribal districts. The State Vision document also directs the promotion of kitchen gardens in schools, Anganwadi centres and communities. In keeping with the State Vision, efforts must be taken to widen the

kitchen garden initiative with nutrition focus. Rural households, schools, other institutions across all districts, not just tribal areas, must be encouraged to set up kitchen gardens. This initiative should incorporate awareness generation on the importance of diet diversity as also facilitation for planting material for the rural communities.

3. **Strategy for promotion of biofortified varieties must be developed**. Dhanashakti, a biofotified pearl millet variety was developed by Mahatma Phule Krishi Vidyapeeth (MPKV), Rahuri, Maharashtra in collaboration with ICRISAT. In spite of development of a suitable biofortified variety from within the state, no state policy impetus has been given to promote this or any other biofortified varieties. However, Dhanashakti is being cultivated in Maharahtra and the state can draw on the experience of farmers cultivating this variety in developing a strategy for promotion of biofortified varieties.
4. **Right to Homestead land must be recognised**. A comprehensive legislation to ensure that every homestead-less family in rural areas has a right to homestead land needs to be enacted. Homestead plot provided to a homestead-less family shall help in enabling the family build a shelter and take up supplementary activities such as backyard poultry, goat-rearing, horticulture and vegetable cultivation. This would enhance food and nutrition security of families, in addition to ensuring their human dignity. The title to the homestead may be granted in the name of adult woman member/s of the eligible family given the fact that women are primary decision-makers on consumption diversity and that they value household nutrition more than men.
5. **Access to nutritious food in rural markets, through FPOs, must be promoted**. The state government is providing a huge impetus to value chain development and has called for farmers' group formation, infrastructure generation, direct marketing, e-marketing and agri-business entrepreneurship. End-to-end value chain development programmes have been implemented with the potential to stimulate production of principal and high-value crops. There is a need to focus on improving farmer incomes, care must be taken to also provide access to nutritious food, animal produce and processed products in rural markets. Rural markets can be modernized and Farmer Producer Organisations (FPO) or agri-businesses can be incentivized to reach under served areas.

6. **Capacity building initiatives among women farmers' groups must be enlarged and strengthened.** Given the important role played by women in agriculture as well as nutrition, SHGs and women farmers groups based livelihood programmes like the Mahila Kisan Sashaktikaran Pariyojana carry significant potential to empower women in agriculture and transform rural diets. Group-based programmes also ease the effort on extension workers as groups themselves can act as agents of change in their communities.
7. **Strategies to improve fish production and local availability must be adopted.** Several recommendations have been noted by the Task Force on Agricultural Development for enhancing fish production in the state. Implementation of the recommendations with regard to improving production as also supporting infrastructure facilities such as cold storage will enhance the availability and affordability of fish across rural areas.
8. **Strengthening the agricultural extension system** would be necessary so that farmers can receive appropriate technical guidance for adopting the FSN approach. It would be necessary to address the large number of vacancies that exists within the agriculture extension services in Maharashtra.

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## APPENDIX – A

## REVIEW OF POLICY AGENDA: GOALS AND VISIONS RECOGNIZED BY THE MAHARASHTRA STATE GOVERNMENT

**Part A of Review of Policy Agenda: GENERAL AGENDA STATEMENTS EXTRACTED FROM LISTED SOURCES***

| | | |
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| **CORE DOMAINS** | **1. Agricultural Production Diversity** | *'- Promote integrated farming system approach for sustainable farm income through land and watershed development, crop husbandry, dairy development, fisheries, apiculture, sericulture, etc. Planning for farming systems must be need-based and demand driven.*<br>*- In dryland areas, 'Dry land Farming Mission' to promote dairy farming, fisheries, apiculture, sericulture, sheep rearing, etc. considering village as a unit for development*<br>*- Create awareness for selection of proper crop, promote inter- cropping and mixed cropping to avoid risk of failure of main crop*<br>*- Implement and expand parasbag or kitchen garden scheme in tribal and rural areas to increase local production of vegetables and fruits and reduce malnutrition. Invite NGOs to provide linkages and training. Encourage kitchen gardens in schools, AWCs, communities, ashram lands.*<br>*- Empower agriculture extension workers to support families and communities to produce and consume locally available crops and to rear animals of improved nutritional quality*<br>*- Provide fresh local foods to children through ICDS in tribal areas using funds allocated for tribal development. Eg. Milk, eggs, banana, potatoes, groundnut, gur and dates* |
| | **2. Agricultural Production** | *'- Bridge yield gaps by improving quality of input supply*<br>*- Reduce cost of cultivation by reducing seed requirement, identifying sustainable technology for fertilizer, early warning systems for pests and diseases, encouraging mechanization*<br>*- Provide statutory framework for facilitating leasing of private land for agricultural purposes so as to improve productivity.* |

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| | *- Seed - Improve varietal replacement, use of certified seed and seed replacement ratio (SRR), promotion of drought resistant and pest resistant varieties, implementation of Seed Production Program and Seed rolling plan, encourage retention of self produced seed for three years without seed replacement for self Pollinated crops*<br>*- Fertilisers & Pesticides - Use of fertiliser & micro nutrient according to soil health card (SHC) use of bio-fertilisers, organic matter, etc.*<br>*- Min 10% of cultivable area to be brought under Low External Input Sustainable Agriculture, preferably organic farming*<br>*- Set up Common Service Centres under PPP mode to provide a range of agri-information on monsoon trends, markets and technology including crop protection*<br>*- End to end project in each block on PPP or contract farming format - providing all relevant interventions on tech dissemination, farmer group formation, decentralized input production/supply, plant protection, post-harvest management, storage and marketing*<br>*- Improve the flow of techonology from researchers to farmers through FFS,cyber extension and increased use of IT in agriculture dept for e-governance and awareness creation*<br>*- Role of Agricultural Universities to be made more effective and focus on their research for effective* |
| **3. Biofortification** | - |
| **4. Agricultural Value Chains** | *- Promotion of farmer groups, crop-specific groups on the line of grape grower association and FPOs for collective procurement of inputs and marketing of outputs*<br>*- End to end project in each block on PPP or contract farming format - providing all relevant interventions on tech dissemination, farmer group formation, decentralized input production/supply, plant protection, post-harvest management, storage and marketing*<br>*- Promote contract farming that insists on strict quality restrictions such as organic farming, minimal residue levels and assist technology adoption. This will also facilitate* |

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| | | *price discovery for farmers*<br>*- Set up Common Service Centres under PPP mode to provide a range of agri-information on monsoon trends, markets and technology including crop protection*<br>*Improvement in market infrastructure, transport and communication*<br>*- Establish value chains through PPP for Integrated Agriculture Development, support to farmer groups, FPOs, FPCs*<br>*- Establish MSMEs run by educated youth or farmer groups to produce crucial inputs like bio-fertilizers, bio-pesticides, small storage structures and processing units depending on local cropping pattern.*<br>*- Decentralized storage structures will be established in each village through linkages with banking institutions and spot exchanges.*<br>*- Promotion 'Godown Receipt Scheme' and contract farming to help farmers to get money in distress and sale the produce when the prices pickup*<br>*- Development of post-harvest technology, storage and processing facilities, product branding for value addition, GI mapping activity to fetch better price for produce along with exports in commodities*<br>*- Hierarchy of markets - village markets, farmer's markets, private markets, terminal markets will be established with at least one in each APMC area over the next 10 year period to promote direct marketing and e-trading. Dhanya Mahotsav platform for direct marketing will be expanded.*<br>*Revamping of role of PACS in direct marketing.*<br>*- Provision of simple and effective marketing strategies - direct marketing, e-marketing, online marketing intelligence service to enhance price realization for farmers.*<br>*- Establish agri-clusters based on production strengths of different regions - develop capacity using end-to-end integrated programs, food parks, micro-clusters of food processing companies*<br>*- Provision of infrastructural and legal support for agricultural exports - Online registration, phyto-sanitary certification, residue testing and National Accreditation* |

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| | | *Board for Testing & Calibration Laboratories (NABL) accreditation, efforts to obtain organic certification* |
| **NON-CORE DOMAINS** | **5. Nutrition Education and Behaviour Change Communication** | *'- Nutrition education should be given to all mothers and care givers for diet diversity to include macronutrient dense and micronutrient rich foods and use iodized salt in their diets*<br>*- Strengthening of ICDS in "mission mode" to improve impact during pregnancy and first two years - implement Village Development Centres (VDCs), give importance to counseling for mothers and families, early child care education on nutrition and hygiene with focus on first 1000 days, smart anganwadi implementation, aadhar enrolment of children, accreditation for better perfoming districts, blocks and villages, intensify efforts in high-burden areas*<br>*- Ensure that monthly mother-child days are held in at least 80% of anganwadi centers around the state to improve health education of communities*<br>*- Reduction of malnutrition by implementing IYCF policy, creating more Child Treatment Centres (CRCs) and Nutritional Rehabilitation Centers (NRCs)*<br>*- Focus on nutrition education/awareness to prevent malnutrition. Develop holistic nutrition policy and food fortification policy* |
| | **6. Women's Empowerment** | *- Social and Economic empowerment of women to contribute as equal partners in development of the State*<br>*- Gender responsive budgeting for the state*<br>*- Convert girls in to assets through education, skill development, employment, enabling equity in decision making - by implementing Majhi Kanya Bhagyashree and SABLA scheme, CSR initiatives for skill development*<br>*- Providing assistance to women micro-livelihood programs*<br>*- Collaboration with Industry for reduction of malnutrition, improved early child Care Education, Women empowerment, etc*<br>*- Information and education campaigns and rewards to families for improving child sex ratio*<br>*- Give 'kad-dhanya' or pulses to tribal, SC* |

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| | | *pregnant and lactating mothers, as protein is missing from their diet. Also give gur, soya flour and ground-nuts package for iron and protein. Give one free community meal daily to all pregnant women in a village during their pregnancy period.* |
| | **7. Natural Resource Management** | *- Implement initiatives to improve climate change management - Weather based crop advisories; Emerging pest management, Trap crops; Wind breaks, Shed net, Green House; Crop diversion, etc.*<br>*- Emphasize soil health programs*<br>*- Promote in-situ moisture conservation by introducing techniques of contour cultivation, strip, inter and mixed cropping, mulching and installtion of bunding and furrows*<br>*- Increase water productivity by improving irrigation, coverage of watershed and farm ponds*<br>*- Soil and water conservation work through govt schemes and participatory approach should be encouraged - such as in the Jalyukt Shivar initiative*<br>*- Min 10% of cultivable area to be brought under Low External Input Sustainable Agriculture, preferably organic farming*<br>*- Promote contract farming that insists on strict quality restrictions such as organic farming, minimal residue levels and assist technology adoption. This will also facilitate price discovery for farmers* |

**Part B of Review of Policy Agenda: AGENDA STATEMENTS EXTRACTED FROM LISTED SOURCES* - FOR MAJOR NUTRITIOUS CROPS/LIVESTOCK (IN CORE DOMAINS)**

| | Legumes | Nutri-cereals/Millets | Horticulture | Livestock and poultry | Aquaculture |
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| **1. Agricultural Production Diversity** | - | *- '- Implement initiative for Nutritional Security through Intensive Millets Promotion (INSIMP) generating job for women and rural youth along with value addition* | | *'- Promote composite livestock farming (2 Cows, 2 Goats and 25 Desi poultry) - Encourage backyard poultry development as a potent tool for addressing livelihood, poverty elevation and nutritional issues through National Livestock Mission (NLM) - Effectively implement schemes viz. goat farming, backyard poultry, dairy for self help groups through Mahla Arthik Vikas Mandal (MAVIM)* | |

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| **2. Agricultural Production** | - | - | *'- Productivity enhancement for principal crops, horticulture and floriculture*<br>*- Promotion of protective cultivation in poly houses, green houses, shed nets* | *'- Genetic improvement of cattle & buffalo up to 60 per cent as per strategy under National programme for bovine breeding (NPBB)*<br>*- Introduction of artificial insemination, emrbyo transfer, in-vitro fertilisation technology for breed proliferation.*<br>*Modernization of bull rearing farmers in tune with Central Monitoring Unit norms.*<br>*- Reducing Fodder insufficiency, increased production of fodder, acreage of land under fodder cultivation and popularise Azola Cultivation, Hydroponics, etc. to meet the growing* | *'- Comprehensive plan for inland fisheries development for doubling the fish farm productivity*<br>*- Facilitating marine fish production in sustainable manner & promoting introduction of Brackish water fishery* |

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| | | | | *demand of fodder through NLM and RKVY*<br>*- Improve availability of nutritive fodder, Enrichment of low quality Fodder with various techniques*<br>*- Set up laboratory infrastructure for quick diagnosis of livestock diseases for economical important diseases. Screening of animals for contagious diseases and metabolic disorder*<br>*- Set up sheep & goat farms of state to commerciall y viable Genome resource farms through Rashtriya krishi vikas yojana (RKVY)*<br>*- Revise breeding policy for bovine with* | |

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| | | | | *emphasis on upgrading with indigenous breeds with animal identification , performance recording, selective & planned breeding.*<br>*- Pursue patentisation and conservation of indigenous sheep and goat breeds* | |
| **3. Biofortification** | - | - | - | *NA* | *NA* |
| **4. Agricultural Value Chains** | *- '- Initiative for Nutritional Security through Intensive Millets Promotion (INSIMP) generating job for women and rural youth along with value addition* | - | *'- Promote F&V for dual objective of - tapping global opportunities , improve food security.*<br>*- Direct marketing of F&V in major cities will be expanded* | *'- Reducing human malnutrition through Milk and Milk by products*<br>*- Setting up of export zones and food parks for animal origin protein*<br>*- Marketing of milk and milk by products of indigenous breeds* | *'- Improve hygiene and quality of fish and fish by-products to meet International Standards and to open up opportunities for the Domestic Industries to compete in the International market* |

***See *References – Agenda documents* for list of sources**

## APPENDIX – B

## REVIEW OF POLICY ADOPTION: SCHEMES AND PROGRAMS ADOPTED BY THE MAHARASHTRA STATE GOVERNMENT

### Part A of Review of Policy Adoption: GENERAL SCHEMES AND PROGRAMS EXTRACTED FROM LISTED SOURCES*

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| **CORE DOMAINS** | **1. Agricultural Production Diversity** | 1. State Plan: Kitchen gardens in tribal districts<br>2. Maharashtra Project on Climate Resilient Agriculture (World Bank assistance)<br>3. Mahila Kisan Sashaktikaran Paryojana<br>4. NMSA: Cropping systems suitable to bio-physical environment promoted under Climate Change and Sustainable Agriculture Monitoring, Modelling and Networking (CCSAMMN)<br>5. IWMP and NMSA: Rainfed area and watershed development using mixed cropping patterns. Livelihoods, production system and microenterprise promotion. |
| | **2. Agricultural Production** | 1. State Plan: Subsidy on agricultural implements, DAP and complex fertilizers, Special Component Plan subsidy, strengthening of fertilizer testing<br>2. National Food Security Mission (NFSM): Demonstrations on hybrid paddy cultivation, SRI, cropping systems, commercial crops. Input subsidy for micronutrients and plant protection.<br>3. Rashtriya Krishi Vikas Yojana (RKVY):<br>4. State Plan: Provision of stability for dryland farming<br>5. State Plan: Plant protection scheme, Pest surveillance and advisory project (CROPSAP) for management of pests in rice, chickpea, pigeonpea, cotton and soyabean<br>6. National Mission on Agriculture Extension and Technology (NMAET): Sub-mission on agricultural mechanization, agricultural extension, plant protection and quarantine, seed and planting material<br>7. State Plan: Promotion of mechanization on custom hiring basis<br>8. Central Schemes for Organic Farming: Paramparagat Krishi Vikas Yojana (PKVY), National Project on Organic Farming, National Mission for Sustainable Agriculture (NMSA), setting up of vermicompost units<br>9. State Organic Farming Policy: Research and training, Improve soil fertility rate through use group based promotion and subsidy of organic |

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| | | farming, Vidarbha package - Technology Mission for Organic Farming<br>10. Seed programs - Taluka Seed Multiplication Farm, Village Seed Production Program, Seed Treatment Campaign (Centrally sponsored 100%)<br>11. Mahila Kisan Shashaktikaran Paryojana<br>12. State Plan programs for extension: Krishi Unnati Yojana - Sub-mission on support to state agricultural extension programme, Agricultural Information Unit operations, shetkari magazine, Demonstration of Newly Developed Agricultural and Horticulture Equipments at Farmers Fields.<br>13. Vidarbha package - Assistance to economically backward farmers for agricultural production, Convergence of Agri-Interventions in Maharashtra (IFAD funded) |
| | **3. Biofortification** | - |
| | **4. Agricultural Value Chains** | 1. Maharashtra Project on Climate Resilient Agriculture (World Bank assistance)<br>2. State Plan: Promotion of group farming<br>3. State Plan: Skill development program for entrepreneurship development<br>4. State Plan: Promotion of cold chain, value chain and agro processing industry<br>5. Implementation of National Food Processing Mission<br>6. State Organic Farming Policy: Certification, marketing and promotion of organic produce<br>7. Maharastra Agricultural Competitiveness Project (World Bank funded)<br>8. Convergence of Agri-Interventions in Maharashtra (IFAD funded)<br>9. Agri-business Infrastructure Development Project (ADB funded)<br>10. State Plan: Provision for stability of dryland farming |
| **NON-CORE DOMAINS** | **5. Nutrition education and Behaviour Change Communication** | 1. Integrated Child Development Services<br>2. Central schemes for adolescent girls: Kishori Shakti Yojana, SABLA Scheme<br>3. Central schemes for women: Pradhan Mantri Matritva Vandana Yojana/Indira Gandhi Mattritva Sahyog Yojana<br>4. State Plan: Establishment of Village Child Development Centres for Malnourished Children<br>5. National Nutrition Mission |

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| | **6. Women's Empowerment** | 1. State Plan: Women's education and skill development schemes -Mazi Kanya Bhagyashree, Peedit Mahila and Balak Manodhairya Yojana, grants to Mahila Arthik Vikas Mahamandal<br>2. Central schemes for adolescent girls: Kishori Shakti Yojana, SABLA Scheme<br>3. Central schemes for women: National Mission for Empowerment of Women, One Stop Centre, Prevention of violence against women, State Commission for Women, Gender Cell, Anti-human trafficking measures, Pradhan Mantri Matritva Vandana Yojana/Indira Gandhi Mattritva Sahyog Yojana<br>4. Swadhar Greh Yojana<br>5. Establishment of State Mission Authority for Women's Empowerment<br>6. Establishment of women multipurpose community |
| | **7. Natural Resource Management** | 1.NMSA and State Plan: Soil Health Card, Improvement of soil health, Soil Health Management Sub-Mission,<br>2. IWMP/RKVY/Pradhan Mantri Krishi Sinchayi Yojana/Har Khet ko Pani: micro/lift irrigation subsidy program, micro irrigation for horticulture<br>3. State sponsored micro-irrigation program<br>4. Jalyukt Shivar Abhiyaan<br>5.NMSA: On-farm water management, Rainfed Area Development, Climate Change and Sustainable Agriculture Monitoring, Modeling and Networking (CCSAMMN)<br>6. Organic farming policies: Paramparagat Krishi Vikas Yojana<br>7. State Organic Farming Policy: promotion of organic produce<br>8. National biogas and manure management program<br>9. Maharashtra Project on Climate Resilient Agriculture (World Bank assistance) |

**Part B of Review of Policy Adoption: SCHEMES AND PROGRAMS EXTRACTED FROM LISTED SOURCES* - FOR MAJOR NUTRITIOUS CROPS/LIVESTOCK (IN CORE DOMAINS)**

| | Legumes | Nutri-cereals/Millets | Horticulture | Livestock and poultry | Aquaculture |
|---|---|---|---|---|---|
| **1. On-farm Production Diversity** | 1. NFSM: Intercropping demonstrations and cropping system demonstrations for rice-rice-pulse and blackgram-greengram<br>2. RKVY: Promotion of pulse cultivation in rice fallows | | | 1. National Livestock Mission - Promotion of rural backyard poultry | |
| **2. Agricultural Production** | 1.NFSM-Pulses : Accelerated pulses production program<br>2. Integrated Pulses Production Program | 1. Special Food Grain Production Programme/Integrated Cereal Development Programme (Centrally sponsored)<br>2.Integrated Maize Production Programme (Centrally sponsored 75%) | 1. MIDH<br>2. Vegetable nurseries, fruit nurseries and station gardens | 1. State Plan: Distribution of goats and cows on 50% subsidy as pilot scheme under Marathwada package, Supply of milch animals to SC/ST beneficiaries, Special component plan - supply of cross-breed milch cow and supply of animal feed<br>2. Integrated Cattle Development Project<br>National Livestock Mission - Feed | 1. Modernization/ Construction of fishing harbours, jetties and ports<br>2. Loan assistance for mechanization of fishing boats, Reimbursement of sales tax on high speed diesel<br>3. Establishment of freshwater prawn seed hatchery, fish seed centers<br>4. Fish farming in impounded |

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| | | | | and Fodder development - modernization of feed-testing labs, fodder production on non-arable government land, introduction of silage unit, chaffcutter, Integrated Fodder Development Program<br>3. State Plan programs for feed and fodder: Demonstration of azolla production, Establishment of production units for area specified feed mixture, bypass protein, and silage, Development of grassland including grass reserve, quality control and animal nutrition laboratory<br>4. Intensive Poultry development blocks, establishment of poultry breeding farms and hatcheries<br>5. National Livestock Mission - Cattle Insurance Scheme<br>6. National Program for | waters<br>5. Assistance for the purchase of fisheries requisites |

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| | | | | Bovine Breeding, establishment of district AI centres<br>7. State Plan: Assistance to MLDB for cattle and buffalo breeds development program, Comprehensive hereditrary improvement program in cattle and buffalo to improve milk production, Conservation of berari goats, Goshala and Panjarapol Development Scheme, Govardan Govansh Raksh Kendra, Sheep breeding farm<br>8. Scheme for Integrated Development for Ruminants and Rabbits, Punyashlok Ahilyadevi Maharashtra Sheep and Goat Development Board<br>9. State Plan - Navinya Purna Yojana : Supply of broilers for contract farming, of goat units, milch animals under cattle development | |

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| | | | | state plan<br>10. National Schemes for Disease Control : National Animal Disease Reporting System, Animal disease surveillance monitoring, National Control Program for various diseases<br>11. State Schemes for Disease Control: ASCAD - Immunization against economically important diseases, information, education and communication campaign, Animal disease management and regulatory medicine at the Western Regional Disease Diagnostic Laboratory<br>12. Animal husbandry extension | |
| **3. Biofortification** | | | | NA | NA |

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| **4. Agricultural Value Chains** | | | | 1. State Plan: Support to Sheep and Wool Corporation<br>2. Integrated Dairy Development Project<br>3. Rehabilitation of loss-making Milk unions and cooperatives | 1. Establishment of Maharashtra Animal and Fisheries Science University<br>2. Establishment of Fish Farm Development Agency<br>3. Development of fisheries co-operative societies |

***See *References – Policy documents* for list of sources**

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