IMPROVING PRODUCTIVITY OF DRYLANDS BY SUSTAINABLE RESOURCE UTILISATION & MANAGEMENT

Devi Dayal
Deepesh Machiwal
Shamsudheen Mangalassery
R.S. Tripathi
Improving Productivity of Drylands by Sustainable Resource Utilisation and Management
Improving Productivity of Drylands by Sustainable Resource Utilisation and Management

Editors
Devi Dayal
Deepesh Machiwal
Shamsudheen Mangalassery
*R.S. Tripathi

Central Arid Zone Research Institute, Regional Research Station
Kukma, Bhuj – 370 105, Gujarat, India
*Central Arid Zone Research Institute
Jodhpur – 342 003, Rajasthan, India

NEW INDIA PUBLISHING AGENCY
New Delhi – 110 034
Drylands cover about 41% of the global land area and are inhabited by 40% of the global population, 90% of which are located in developing countries. Drylands are characterised by the scarcity of water with reduced length of growing period of 1–179 days. Drylands cover 76% of geographical area in India. The major constraints in dryland farming are the scarcity of water arising from low and erratic precipitation and high evaporative losses which affect primary productivity and consequently the human and livestock population. Increased population growth and continuous pressure on limited natural resource base along with increased frequency of drought events, has led to land degradation in drylands. Due to the various constraints, the agriculture in these areas as such, is non-sustainable, and the yields are highly variable. The over exploitation of resources has been deteriorating the resource base. Researchers from dry areas all over India have been engaged in addressing different issues affecting the productivity and sustainability of dry areas. This compilation comprises of research findings and technologies in different fields which were presented and discussed during the Silver Jubilee celebration of Regional Research Station of Central Arid Zone Research Institute, Bhuj, India in the National Symposium on “Resource Utilisation through Integrated Farming System and Biodiversity Conservation in Drylands” during December 20-22, 2011. The 30 chapters included in this book addresses various core issues of dry land management that include dryland biodiversity, natural resource management, land and livestock management, engineering and post-harvest technology and socio-economic issues. It is hoped that, if these technologies adopted by stakeholders it will improve the profitability and sustainability of the system, besides improving natural resource base in the region.
I appreciate the efforts of the editors for compiling the chapters and bringing out this publication. I am confident that this publication will be very useful to the researchers, farmers and the extension agencies engaged in agriculture for improving the productivity and sustainability of agriculture in the Indian drylands.

R.K. Bhatt

Date: 22 August, 2015
Place: Jodhpur

Director
CAZRI, Jodhpur
I appreciate the efforts of the editors for compiling the chapters and bringing out this publication. I am confident that this publication will be very useful to the researchers, farmers and the extension agencies engaged in agriculture for improving the productivity and sustainability of agriculture in the indian drylands.

R.K. Bhatt

Date: 22 August, 2015
Place: Jodhpur

Director
CAZRI, Jodhpur
Preface

India has 76% of its global area under the drylands consisting of arid, semi-arid and dry sub-humid regions. Drylands play a dominant role in agricultural production of the country, contributing about 42% of the total food grain production, and more than 90% of sorghum, millets and pulses production. A large population of livestock with many of the best and hardy breeds of animals is its another strength. However, land degradation due to climatic peculiarities and high human and livestock pressures on the natural resources is a major concern due to its impact on biological production potentials of the land. The rate of natural resources exploitation and resultant land degradation is much faster in the fragile drylands, which needs greater attention of the researchers, technocrats and policy planners. The hot arid areas are the most vulnerable due to their erratic rainfall and degraded natural base vis-à-vis high population densities. Although scientific research during the last few decades has led to many technologies and strategies for sustainable management of the drylands, the information still remains scattered. Meanwhile the threats of climate change are making additional demands of understanding of the changing variables and means of tackling the adverse impacts of the changes or reaping benefits of any new opportunities.

Realizing the importance of drylands in country’s agricultural production and the typical nature of their agriculture-related problems, ICAR – Central Arid Zone Research Institute (CAZRI) and Arid Zone Research Association of India (AZRAI) jointly organized a National Symposium on “Resource Utilisation through Integrated Farming System and Biodiversity Conservation in Drylands” during December 20-22, 2011 as part of the Silver Jubilee celebration of CAZRI, Regional Research Station, Bhuj, Gujarat. The symposium was co-sponsored by ICARDA, Syria, KSKV Kachchh University and M/s AgroCell. In all, 138 abstracts were received under six
major themes of the symposium, first theme on dryland biodiversity and its conservation; second theme on natural resources and their management; third theme on crop land management; fourth theme on livestock production and management; fifth theme on engineering, energy and post-harvest technology; and sixth theme on socio-economic and gender issues.

After successful completion of the symposium, authors of the selected abstracts were invited to submit full-length papers for further compilation as the edited book. In response, 45 full-length papers were received, which were subsequently subjected to reviewing process by at least two referees. All the papers were thoroughly revised by the authors according the referees’ comments and then edited by the editors. Finally, 30 papers were selected to be retained in this compiled and edited publication. The financial help received from all the co-sponsors is gratefully acknowledged. As editors of the book, we express our gratitude to the authors who submitted their manuscripts in a timely manner to us. We also thank many scientists and professors who served as reviewers for the chapters. In addition, we express our sincere appreciation to the New India Publishing Agency, New Delhi and their editorial team for accepting proposal of this book for making the publication.

Devi Dayal
Deepesh Machiwal
Shamsudheen Mangalassery
R.S. Tripathi
Contents

Foreword v
Preface vii
List of Contributors xiii
List of Reviewers xvii

1. Climate Resilient Agriculture: Research and Development Initiatives in India 1
   B. Venkateswarlu

2. Crop Diversification through Groundnut for Enhancing Resource Utilization Efficiency: An Appraisal 11
   N.K. Jain and J.B. Misra

3. Farming Systems in the Indian Arid Zone for Sustainability in Agriculture 27
   N.L. Joshi

4. Feeding Management of Livestock during Drought Situations in Dry Regions of India 43
   N.V. Patil and K.M.L. Pathak

5. Biodiversity of Cold Arid Regions of Ladakh and its Conservation 61
   Bimal Misri

6. Production and Management Strategies for Improving Buffalo Productivity 69
   R.K. Sethi

7. Need of Soil and Water Conservation Measures in Arid Kachchh District of Gujarat 83
   Deepesh Machiwal, Devi Dayal and Sanjay Kumar
8. Performance of Selected Crops and Grasses under Varying Soil Depths in the Arid Region of Gujarat
   S. Mangalassery, Bhagirath Ram, S.L. Meena, Arvind Kumar and Devi Dayal
   97

9. Soil Fertility Appraisal in North Eastern Parts of Indian Thar Desert
   Mahesh Kumar, P.C. Moharana, Amal Kar, P. Raina, S.K. Singh and N.R. Panwar
   105

10. Recycling of Organic Wastes by Different Composting Techniques for Sustainable Agriculture
    A.B. Singh and A. Subbã Rao
    115

11. Improving Crop Water Productivity: Needs and Options
    V.S. Rathore, Birbal, N.S. Nathawat, S. Bhardwaj, Raj Singh and N.D. Yadava
    127

12. Genetic Divergence Analysis in Land Races of Forage Sorghum [Sorghum bicolor (L.) Moench]
    S.K. Jain, P.R. Patel and M. Elangovan
    151

13. Host Inventory and Relative Abundance of Fruit fly Species in Semi Arid Region of North Gujarat
    F. K. Chaudhary and G. M. Patel
    151

    S.L. Meena and F.J. Massawe
    171

15. Diversity of Nitrogen Fixing Bacteria in Selected Tree Species of Arid Zone in India
    Anjly Pancholy, S.K. Jindal and S.K. Singh
    183

16. Multivariate Analyses in Sorghum (Sorghum bicolor L. Moench) for Fodder Yield and Their Attributes under Semiarid Condition of Gujarat
    S.K. Jain and P.R. Patel
    197

17. Developing Brinjal Genotypes for Cultivation under Hot Arid Agro-Climate
    Hanif Khan and D.K. Samadia
    205
   Devi Dayal, Arvind Kumar, M.L. Swami, Deepesh Machiwal, S. Mangalassery, S.C. Vyas and Hargovind Kunpara

19. Variability, Heritability and Character Association for Seed Yield and its Components in Buffel Grass (Cenchrus ciliaris Linn.) 225
   M.P. Rajora and R.K. Bhatt

20. Shrubs of Hot Arid Region: Diversity, Utilization and Conservation 235
   J.P. Singh and V.S. Rathore

   Bhagirath Ram, Devi Dayal, S. Mangalassery, Arvind Kumar, S.L. Meena and Narendra Kumar

22. Agro-morphological Evaluation of Sesame (Sesamum indicum L.) Cultivars under Low Input Environment of Arid Ecosystem 263
   Arvind Kumar, Devi Dayal, S. Mangalassery, Deepesh Machiwal and S.C. Vyas

23. Assessment of Sesame (Sesame indicum L.) Cultivars under Different Rainfall Regimes in Arid Gujarat 277
   Arvind Kumar, Devi Dayal, Bhagirath Ram and S. Mangalassery

24. Effect of Rainfed Intercrops and Irrigation Levels on Growth and Yield of Fruit Trees in Agri-Horti System in Western Rajasthan 293
   N.D. Yadava, M.L. Soni, V.S. Rathore and Birbal

25. Fodder Yielding Potentiality of Pop Sorghum Genotypes Under Different Nitrogen and Seed Rate Levels 301
   H.V. Ganesh, S.C. Alagundagi, and S.V. Hosamani

26. Effect of Tillage Practices on Yield of Rainfed Castor 309
   R.M. Solanki, B.M. Dabhi and B.K. Sagarka
27. Resource Use Efficiency as Influenced by Weed Management Practices in Cumin under Arid Region of Rajasthan
   Raj Singh and Anurag Saxena
   317

28. Enhancing Socio-economic Status of Farmers through Dairy Entrepreneurship
   329

29. Economics of Arable Crops Production in Arid Gujarat
   Khem Chand, Shalander Kumar, Devi Dayal, B.L. Jangid and S. Mangalassary
   337

30. Design of Natural Convection Type Solar Tunnel Dryer for Rural Area
   M.S. Dulawat, Alok Gora and M.S. Seveda
   349