

| | |
|---|-------------|
| <i>List of Tables</i> | <i>xiii</i> |
| <i>Preface</i> | <i>xvii</i> |
| <i>Acknowledgement</i> | <i>xxi</i> |
| 1. Status and Perspective of Indian Agriculture | 1 |
| 1.1 Introduction | 3 |
| 1.2 Recent Growth Rate | 5 |
| 1.3 Compound Growth Rates of Area, Production and Productivity of Principal Crops | 6 |
| 1.4 Growth Trend of Production and Productivity of Principal Crops | 7 |
| 1.5 The Per Capita Net Availability of Food Grains | 7 |
| 1.6 Agricultural Exports | 9 |
| 1.7 Growth Strategies – Key Constraints and Opportunities | 12 |
| 1.8 Technological Constraints | 15 |
| 1.9 Issues and Challenges in Availability of Agricultural Inputs – Seeds and Fertilizers | 20 |
| 1.10 Resource Constraints | 22 |
| 1.10.1 Sub-division and fragmentation of holdings | 22 |
| 1.10.2 Land degradation | 23 |
| 1.10.3 Water | 24 |
| 1.11 Capital Constraints | 24 |
| 1.11.1 Agricultural investment | 25 |
| 1.11.2 Capital formation in agriculture | 28 |
| 1.12 Total Factor Productivity | 29 |
| 1.13 Input Subsidies and Public Investment in Agriculture | 31 |
| 1.14 Status of Agriculture Subsidies | 32 |
| 1.15 Institutional Credit | 32 |
| 1.16 Feasibility of Achieving a 4 per cent Growth Rate | 33 |
| 1.17 Global Scenario | 35 |
| 1.18 Perspectives | 37 |
| 2. Natural Resource Management | 39 |
| 2.1 Introduction | 41 |
| 2.2 Status of Resources | 42 |

| | | |
|-----------|--|-----------|
| 2.2.1 | Soils | 42 |
| 2.2.2 | Water | 44 |
| 2.2.3 | Agro-biodiversity and conservation of genetic resources | 45 |
| 2.2.4 | Livestock | 47 |
| 2.3 | Strategies for Natural Resources Management | 47 |
| 2.3.1 | Land | 48 |
| 2.3.2 | Water | 51 |
| 2.3.3 | Biodiversity | 55 |
| 2.3.4 | General | 56 |
| 3. | Conservation Agriculture | 59 |
| 3.1 | Introduction | 61 |
| 3.2 | Elements of CA | 62 |
| 3.3 | Guiding Principles | 64 |
| 3.3.1 | Mulching | 65 |
| 3.3.2 | Conservation tillage | 66 |
| a. | Ridge Tillage | 67 |
| b. | No-till | 68 |
| 3.4 | Capacity Building | 68 |
| a. | Sharing of scientific information | 69 |
| b. | Policy initiatives | 69 |
| c. | Management approach | 69 |
| 4. | Dryland/Rainfed Agriculture | 71 |
| 4.1 | Introduction | 73 |
| 4.2 | Main Features of Dryland Agriculture | 75 |
| 4.3 | Principal Dry Farming Zones in India | 76 |
| 4.3.1 | The Indo-Gangetic Plains (IGP) | 76 |
| 4.3.2 | The trapian plateau of peninsular India | 77 |
| 4.3.3 | Plateau of granite formation | 77 |
| 4.4 | What Ails Dry Farming in India? | 77 |
| 4.4.1 | Moisture stress and uncertain rainfall | 78 |
| 4.4.2 | Effective storage of rain water | 78 |
| 4.4.3 | Marketing of produce | 78 |
| 4.4.4 | Selection of crops | 79 |
| 4.4.5 | Careful and judicious fertilization scheduling | 79 |
| 4.4.6 | Utilization of conserved moisture | 79 |
| 4.4.7 | Quality of produce | 79 |
| 4.5 | Approaches for Sustaining Productivity | 80 |
| 4.5.1 | Agronomic approaches | 80 |
| 4.6 | Cropping Systems and Patterns in Dry | |

| | | |
|-----------|--|------------|
| | Farming Areas | 82 |
| 4.7 | Weed Control and Moisture Conservation | 83 |
| 4.8 | Plant Protection Measures | 83 |
| 4.9 | Rainwater Harvesting | 83 |
| 4.10 | The Components of Developing Sustainable Farming Under Dryland Agriculture | 84 |
| 4.11 | Technologies Developed and Available for Transfer | 85 |
| 4.12 | Rainfed Agriculture: Untapped Potential | 86 |
| 4.13 | Future Strategies | 89 |
| 4.14 | Rainfed/ Dryland Contingency Plan | 89 |
| 4.15 | Need for More Supportive Policies | 97 |
| 5. | Strategies to Increase Crop Production | 101 |
| 5.1 | Introduction | 103 |
| 5.2 | Rice | 103 |
| 5.3 | Wheat | 110 |
| 5.4 | Maize | 119 |
| 5.5 | Pearl Millet | 124 |
| 5.6 | Sorghum | 126 |
| 5.7 | Pulses | 129 |
| 5.8 | Estimated Additional Food Grain Production Based on Targeted Productivity | 133 |
| 5.9 | Oilseeds | 134 |
| 5.9.1 | Groundnut | 135 |
| 5.9.2 | Rapeseed and mustard | 137 |
| 5.9.3 | Soybean | 139 |
| 5.9.4 | Sunflower | 141 |
| 5.9.5 | Castor | 143 |
| 5.9.6 | Estimated additional oilseeds production | 144 |
| 6. | Climate-Resilient Agriculture | 145 |
| 6.1 | Introduction | 147 |
| 6.2 | Challenges in Climate Variability | 148 |
| 6.3 | Drought Risk | 149 |
| 6.4 | Climate Variability Management | 151 |
| 6.5 | Climate Prediction | 154 |
| 6.6 | Disseminating Climate Information | 156 |
| 6.7 | Climate-Resilient Crop Cultivation | 157 |
| 6.8 | Development and Adoption of Climate-ready Technologies | 158 |
| 7. | Making Seed Production Programme Vibrant | 161 |

| | | |
|-----------|--|------------|
| 7.1 | Introduction | 163 |
| 7.2 | Seed Supply | 164 |
| 7.3 | Seed Management in Drought Situation | 165 |
| 7.4 | Seed Village Programme | 165 |
| 7.5 | Seed Infrastructure | 165 |
| 7.6 | Varietal Development and Replacement | 165 |
| 7.7 | Movement of Seed from India in International Trade | 165 |
| 7.8 | Seed Mission | 166 |
| 7.9 | Performance of NSC and SFCI | 166 |
| 7.10 | Strategies for Seed Production | 166 |
| 8. | Farm Mechanization | 171 |
| 8.1 | Introduction | 173 |
| | 8.1.1 Farm mechanization in Indian states | 175 |
| | 8.1.2 Trends in Indian agriculture | 175 |
| 8.2 | Challenges in Agricultural Mechanization | 179 |
| 8.3 | Impact of Agricultural Mechanization | 180 |
| | 8.3.1 Precision farming | 180 |
| | 8.3.2 Clean environment | 181 |
| | 8.3.3 Adoption of mechanization | 183 |
| | 8.3.4 Tillage and planting machinery | 183 |
| | 8.3.5 Inter-culture and plant protection equipment | 184 |
| | 8.3.6 Irrigation and drainage equipment | 184 |
| | 8.3.7 Harvesting and threshing | 185 |
| 8.4 | Farm Machinery Adoption and Scope | 185 |
| 8.5 | Service Support in Agriculture | 188 |
| | 8.5.1 Custom hire and service centres for machinery | 188 |
| | 8.5.2 Skill development training and employment generation | 189 |
| | 8.5.3 Income generation opportunities for women | 190 |
| 8.6 | Promotion of Agricultural Mechanization | 190 |
| 8.7 | Policy on Farm Mechanization | 191 |
| 8.8 | Status of the Agricultural Machinery Industry | 193 |
| 8.9 | Agricultural Machinery and Safety | 194 |
| 8.10 | Anthropometric and Strength Data | 196 |
| 8.11 | Ergonomics and Work Comfort | 196 |
| 8.12 | Machinery for the Future | 197 |
| 8.13 | Initiatives of the Government | 198 |
| 8.14 | Regional Agricultural Machinery Testing | |

| | | |
|------------|---|------------|
| | Network | 199 |
| 8.15 | Subsidy on Agricultural Machinery | 200 |
| 9. | Sustaining the Rice-wheat Production System | 203 |
| 9.1 | Introduction | 205 |
| 9.2 | Stagnation of Production and Growth | 206 |
| 9.3 | Ecological Degradation | 206 |
| 9.4 | Sustainability Issues | 207 |
| 9.5 | Promises for the Future | 210 |
| 9.6 | Policy Requirements | 214 |
| 10. | Diversification in Agriculture | 217 |
| 10.1 | Introduction | 219 |
| 10.2 | Horticulture | 220 |
| | 10.2.1 National Horticulture Mission (NHM) | 220 |
| | 10.2.2 Horticulture Mission for North East and Himalayan States (HMNEH) | 221 |
| | 10.2.3 Financial achievements | 221 |
| | 10.2.4 Physical achievement | 221 |
| | 10.2.5 Micro irrigation | 222 |
| | 10.2.6 Integrated Scheme of Oilseeds, Pulses, Oil Palm and Maize (ISOPOM) | 222 |
| | 10.2.7 New technological options | 223 |
| | 10.2.8 Horticultural diversity management | 227 |
| | 10.2.9 Horticulture for nutrition | 228 |
| 10.3 | Animal Husbandry | 229 |
| | 10.3.1 Policy intervention | 230 |
| | 10.3.2 Future thrusts | 231 |
| 10.4 | Fishery Development | 233 |
| | 10.4.1 Fisheries sector | |
| | 10.4.2 Technologies support and innovation | 234 |
| | 10.4.3 Quality fish seed | 235 |
| | 10.4.4 Fish feed production | 235 |
| | 10.4.5 Fish health management | 236 |
| | 10.4.6 Brackish water aquaculture | 236 |
| | 10.4.7 Marine biodiversity, biotechnology and bioprospecting | 237 |
| | 10.4.8 Responsible fishing and regulatory measures | 237 |
| | 10.4.9 Future strategies | 238 |
| 10.5 | Policy Imperatives | 240 |
| 10.6 | Future Strategy | 241 |
| 11. | Revamping Agricultural Extension System | 245 |