AGRICULTURAL SECTOR IN INDIA

ACCELERATING GROWTH AND ENHANCING COMPETITIVENESS

Edited by
Mruthyunjaya

ROUTLEDGE

Agricultural Sector in India

This book presents a comprehensive overview of a range of concepts, methods, strategies and policies in agriculture and natural resource management, environmental economics, production economics and sustainable agricultural development.

It explores effective analytical tools and science, innovations, and management solutions to enhance yields, manage the supply chain, strengthen institutional mechanisms, and service and support systems for farmers. It highlights the importance of enabling policies which can benefit farmers, resulting in cost-efficient and quality-improving farm practices, increased profits and income for farmers, and better management of natural resources. The essays in the book honour the academic, teaching, and research contributions of Professor R. Ramanna in the field of agricultural economics. They also address issues which are relevant to the growing research in sustainable agricultural development and natural resource management including the use of new concepts, tools, analyses, technologies, innovations, and policy strategies modelled in local contexts that can easily be scaled and applied to similar contexts elsewhere.

This book will be of interest and use to students, researchers, practitioners, and policymakers working in varied fields of agricultural economics, sustainable development, public policy, rural sociology, political economy, economics of innovation, institutional economics, and industrial organisation.

Mruthyunjaya is former Director of the National Institute for Agricultural Economics and Policy Research and former National Director of the National Agricultural Innovation Project, Indian Council of Agricultural Research, New Delhi, India.

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M.G. Chandrakanth did his doctoral studies in agricultural economics at the University of Agricultural Sciences, Bangalore, and post-doctoral studies in the institutional economics of groundwater irrigation with the Ciriacy Wantrup fellowship at the University of California, Berkeley. He is the Fellow of the Indian Society of Agricultural Economics conferred in 2013 and received the Fifth Professor RC Agrawal Award of Excellence for outstanding contributions to agricultural economics in 2013. His book on water resource economics was published by Springer in 2015. He served as professor of Agricultural Economics at UAS until 2016, Dean of the College of Agriculture, UAS and retired as the director of the Institute for Social and Economic Change in 2020. He continues his research interests in policy research in agricultural economics and natural resource economics. He is a regular blogger on policy issues in Economic Times and Times of India.

H. Chandrashekar did his master's degree in statistics from Bangalore University in 1978 and a doctoral degree in development statistics from the Centre for Economic and Social Studies (CESS), Hyderabad. He started his career at the Institute for Social and Economic Change (ISEC), Bangalore, and joined as an assistant professor of statistics at the University of Agricultural Sciences, GKVK, Bangalore, and served as Coordinator, Project Planning and Monitoring Cell (PPMC), and professor of statistics. He has contributed to watershed development policy during his eight years of deputation as a statistician in the World Bank-funded Watershed Development Programme and Dry Land Development Board (DLDB), Government of Karnataka. He has co-authored an article in the field of watershed development in Karnataka in the proceedings of the International Association of Agricultural Economics along with Dr K.N. Ninan, ISEC, Bangalore. He also specialises in econometrics and the application of quantitative techniques in social sciences besides serving as a member of NATP's Team of Excellence, natural resources economics, Department of Agricultural Economics, University of Agricultural Sciences, Bangalore, sponsored by ICAR, New Delhi. He served as the member of *Rural Bio-Resource Complex Project sanctioned by the Department of Bio-technology, GOI to UASB*.

P.G. Chengappa is one of the leading agricultural economists of the country. He was president (elect), Indian Society of Agricultural Economics, president, conference president of AERA. He obtained his PhD from IARI New Delhi and undertook an international course on agricultural marketing in Germany. He served as vice chancellor of UAS Bangalore and national professor, ICAR New Delhi. His professional contributions are in agribusiness, trade, and policy. He served in many government-constituted committees relating to agricultural education, research, and extension. He was a consultant to IFPRI, IPGRI, and FAO and a visiting scientist at IRRI, ICRISAT, University of Reading, Wales, and Purdue. He is currently a member of BoG, ISEC, and an independent director on the boards of Tata Coffee Ltd and Tasty Bite Eatables Ltd.

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K.R. Hamsa holds a PhD in agricultural economics from the University of Agricultural Sciences, Bengaluru, India, and participated in an Erasmus Mundus Action II, NAMASTE student exchange programme at the University of Ghent, Belgium. She is a recipient of the "Swami Vivekananda Single Girl Child Fellowship for Single Girl Child Students" for a doctoral degree (PhD) from the University Grants Commission (UGC), New Delhi. Her major research interests include impact assessment, food security, capital formation, agriculture development, and natural resource economics. Currently, she is working as a research associate in the Rural-Urban Interface of Bangalore – A space of transitions in Agriculture, Economics and Society (Phase II) – Sub Project: "Coordination of Indian Partner Projects".

Rajendra Hegde has had a brilliant academic career and did his doctoral studies in agronomy at IARI, New Delhi. He was a gold medallist during his graduation and postgraduate studies in agriculture. He is the recipient of a National Award (Hari Om Ashram Trust Award of ICAR), ICAR-Young Scientist Award, and Karnataka State Youth Awards. He joined ARS in 1992, and he served as an agronomist in the Indian Institute of Spices Research, Appangala, Kodagu, Karnataka, during the beginning of his research career for eight years. Presently he is working as a principal scientist (agronomy) and head of the Regional Center, National Bureau of Soil Survey and Land Use Planning, Bangalore, since May 2015. He was the lead scientist of a multi-institute collaborative World Bank-funded project of the Government of Karnataka on the generation of LRI called Sujala. He is now the lead scientist in the Karnataka Watershed Development project REWRD (World Bank funded) which is being replicated in other states like Orissa. He has published more than 75 research papers in peer-reviewed national and international journals, 610 Land Resources Inventory atlases, and reports and technical bulletins.

Suresh Honnappagol contributed immensely to the all-around growth of the veterinary profession in the country. He served more than 24 years in education, research, and extension management positions. As a vice chancellor of the Karnataka Veterinary Animal and Fisheries Sciences University, he contributed to the establishment of new colleges, research centres, and academic programmes and entered MOU with many reputed national and international institutes. As ADG (EQR) he coordinated the development of minimum standards of higher agricultural education, experiential learning modules, model qualifications for VCs, and finalisation modalities of NAEP. As animal husbandry commissioner, he was responsible for technical matters related to animal health, production, and human resource development and designed the flagship programmes of the Government of India like Rastriya Gokul Mission, NDP-II, etc.

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Vijayalaxmi Khed holds a PhD in agricultural economics from the University of Agricultural Sciences, Bengaluru, India, and participated in a DAAD-sponsored academic exchange at the University of Göttingen, Germany. She was an awardee of national-level research scholarships from the Indian Council of Agricultural Research (ICAR) to pursue her master's and PhD degrees. Her major research interests include technology adoption, impact assessment, gender studies, agriculture development, and farm-household consumption dynamics. Currently, she is working as an associate scientist in agricultural economics at the International Wheat and Maize Improvement Center (CIMMYT) in Hyderabad, India, in the Sustainable Agri-Food System (SAS) programme.

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Mruthyunjaya, with a brilliant academic career, did his doctoral studies in agricultural economics at IARI, New Delhi, receiving a Jawaharlal Nehru Award for outstanding post-graduate research in agriculture from ICAR. He joined ARS in 1976, served in ICAR institutions across India as scientist, professor, ADG, and director (ICAR-National Institute for Agricultural Economics and Policy Research) and was superannuated as national director, NAIP, ICAR, New Delhi, in 2009. His professional contributions are in agricultural economics, R&D policy, and management. He has served in several committees of GoI and as a consultant in many national and international agencies and is widely travelled. He is a fellow of NAAS, ISAE, and served as president of AERA, New Delhi. He was awarded the Dr M.S. Randhawa memorial award for outstanding contributions in agricultural administration, transfer of technology, and social sciences by NAAS, New Delhi.

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Sudha Mysore served as the CEO, Agrinnovate India Limited, a Government of India company established under DARE/ICAR, associated with tech transfer, commercialisation, and start-up support through the National Agricultural Research System (NARS). Prior to this she was a principal scientist at ICAR-Indian Institute of Horticulture Research, Bangalore, with 33 years of work experience in ICAR and now superannuated; Dr Sudha Mysore is a double Fulbright Fellow having won pre-doctoral and post-doctoral fellowships with rich working experience at Cornell University and Michigan State University, East Lansing, USA. Her research efforts include economic analysis, impact assessment research and technology transfer, and commercialisation and incubation. She has handled various research programmes sponsored by the World Bank, NAIP, ICAR, AP cess fund, etc. Her international recognitions include working and presenting at Cornell University and Michigan State University, USA; HORDI – Sri Lanka, Bioversity International, UNEP-GEF Programme, Business School, Toulouse, France, IAAE, Beijing, China, and Chaingmai Thailand, Fruit Net, Kuala Lumpur, Malaysia.

Kiran Kumar R. Patil a brilliant agricultural economist par excellence secured UAS gold medal in both master's and doctoral programmes in agricultural economics, securing an ICAR Jr Research Fellowship during his master's degree and a DST INSPIRE fellowship during his PhD. Currently he is serving as assistant professor of agricultural economics at the College of Agriculture, University of Agricultural and Horticultural Sciences,

Iruvakki, Shivamogga. He is well versed with quantitative techniques including softwares such as R, Eviews, Excel. The American Agricultural Economics Association Wisconsin awarded him the LILMI grant inviting him to present his research article on groundwater economics at its 2015 annual conference, San Francisco. The Indian Society of Agricultural Economics, Mumbai, awarded him the Anamitra Saha Prize for the best article in the *Indian Journal of Agricultural Economics*. He currently has 45 research articles in journals of repute to his credit.

P.S. Prasannakumar carried out doctoral studies in agricultural economics at the University of Agricultural Sciences, Bangalore. He was awarded an international scholarship (Erasmus Mundus Action 2: NAMASTE) to pursue part of his PhD research at the University of Georg-August-Universität Göttingen (UGOE), Germany. His areas of interest pertain to agricultural marketing and agri-business management, farm management and production economics, energy, climate and environmental policy, and environmental and resource economics. He worked as a research associate at the Department of Agricultural Economics, University of Agricultural Sciences, Bangalore, in the Indo-German Collaborative Research Project and played an active role in the coordination of projects between India and Germany. He continues his research focus on rural-urban transitions in agriculture, food and nutritional security, and the consumption and expenditure of farm households.

L.P. Rajan is an alumnus of the prestigious Indian Institute of Management, Bangalore, having done a postgraduate programme in management during 1975–77. He has worked in prestigious companies such as Asian Paints Ltd Mumbai, India, a pioneering company which used information technology early enough to explore modern-day concepts such as supply chain and logistics management when these subjects were just emerging. After a stint of 20 years in various industrial corporations, he entered academia, mostly as head of departments (HoD) of management in engineering colleges in Bangalore. He was HoD at Sir M. Visveswaraya Institute of Technology, Reva Institute of Technology and Management (now Reva University), Jain University, etc. The involvement in academia was over a period of 20 years. Professor Rajan has conducted many training programmes for corporates mostly on management subjects such as conflict resolution, negotiations, strategic management, and supply chain management. A prolific writer, he has published several research papers on the above subjects. As a student of management at the IIM Bangalore, he edited and published case studies in appropriate technology (aka alternate technology) done by fellow classmates, titled "Managing the Choice of Technology". This was one of the first publications from the IIM Bangalore, way back in 1977, and was widely acclaimed.

Shalini Rajneesh, additional chief secretary to the Government of Karnataka, Planning, Programme Monitoring and Statistics Department, Government of Karnataka. She was the woman topper in the Indian Administrative Service (IAS) of the year of 1989. She was a gold medallist in psychology, MBA, from Australia, and holds a PhD in rural development. She has penned 13 books, 8 in English and 5 in Kannada, covering subjects like management, personality development, women empowerment, and IAS coaching. In addition, she regularly writes articles and gives lectures/interviews on TV and radio, and gives seminars to connect to people at large on issues of public interest. Contact details: shalinirajneesh.sr@gmail.com.

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Foreword

I landed in UAS Bangalore on 27 October 1968 from "nowhere" without any exposure to agriculture education, research, and extension. Hence, I had to pass through a transition to a new system that had adopted the US land grant model of education for agriculture and allied sciences.

The curriculum was said to be that of the American system. To get acquainted with this new system, I made the choice of observing the academic activities of "role models" in the university. Professor Ramanna happened to be a "role model" for me, because of his strong commitment to teaching with good preparation. Perhaps nobody could exceed him in drawing diagrams to illustrate economic relationships through geometry.

Before writing the foreword to the book that is brought out in his honour, I feel it is necessary to provide a couple of profiles of this great person. First, he is not merely a "role model" as a teacher, there has been no "replacement" for him. He has been unique, and his value comes simply from being him, "He alone is he". Second, the monumental dedication of Professor Ramanna to his profession has validated one important dictum in philosophy: Obviously as we develop others we permanently succeed. Yes, there is no more noble occupation than to assist another human being to succeed. Third, with all the achievements to his credit, circumstances have conspired to deny the realisation of his modest dreams and aspirations. The troubles and turbulences which he has passed through validate the famous proposition: "The greatest danger to man is man". Professor Ramanna has survived without succumbing to any prolonged bitterness or despair and is still in possession of the essentials of human dignity.

The book *Agricultural Sector in India: Accelerating Growth and Enhancing Competitiveness* is brought out as a token of honour by his students and those to whom he has provided mentoring support. The former students of Professor Ramanna and others have demonstrated their scholarship true to the spirit and commitment of their teacher and mentor. The book has focussed on the analysis of the natural endowments of the state, the performance of subsectors of agriculture, poverty in rural areas, supply

chain management, support systems, and needed agricultural technologies for the sustainability of the sector, secondary agriculture for boosting the rural economy, and strengthening the institutional agriculture credit system. Added to all these, the book has indicated the crucial signposts for formulating an agricultural development model for the state. The "overview" section captures all the main domains and draws useful inferences, and thereby it adds significant value to this book so that the reader can derive useful major perspectives on the theme of this book.

I have no reservations in my mind that the book is valuable material for researchers and for those engaged in decision making for the agricultural development of the state. The book provides a structure for the study of the agriculture sector in other states. All of the state-level studies could provide a strong micro foundation for designing a macro development model for the agriculture sector. NITI Ayog is the right platform for taking this kind of initiative. This in turn would be a great honour to this great teacher, Professor Ramanna.

S. Bisaliah
Former Vice Chancellor
University of Agricultural Sciences, Bengaluru
1 July 2023

The Doyen Professor R. Ramanna: A Tribute

M.G. Chandrakanth

Professor Ramanna's acumen as teacher, researcher, administrator

Professor R. Ramanna and the Department of Agricultural Economics at the University of Agricultural Sciences (UAS) Bengaluru are synonymous. Agricultural economics as a discipline at UAS was born in 1964, with Sri Balachowdaiah and Sri R. Ramanna as lecturers. The subject matter of agricultural economics received a great fillip with the participation of Professor Erwin J. Long and Professor Badenhop, visiting from the USA during 1958–62 on an international exchange programme. In recognition of their teaching skills, Sri R. Ramanna and Sri Balachowdaiah were recommended by Professor Erwin Long for a fellowship to pursue master's degrees in agricultural economics at the University of Tennessee, Knoxville, USA, with sponsorship from the Agricultural Development Council. This was the first milestone, a turning point for the department in a journey towards academic excellence. Upon the completion of Professor Ramanna's master's programme in Tennessee, USA, and a doctoral programme at the Indian Agricultural Research Institute (IARI), New Delhi, the department began operating the master's degree programme from 1968 and the doctoral programme from 1976 under the leadership of Professor R. Ramanna for more than two decades. Thanks to his commitment as an excellent teacher, human resource developer, and institution builder, the programmes won national and international acclaim. Professor Ramanna retired as the dean of the university and also finally as its officiating vice chancellor.

Professor Ramanna: Human qualities par excellence

If students and admirers of Professor Ramanna remember him and revere him so deeply at the age of 94, it is because of his profound personal qualities of moral values, manners, integrity, honesty, discipline, superior communication skills, and solid commitment to equity, efficiency, and the social and academic growth and development of every student and learner.

Professor Ramanna: Work is worship

Professor Ramanna was a very popular teacher, attracting, inspiring, and empowering students with a strong foundation in the theory and practice of the science of agricultural economics. His secrets of teaching included: (1) serious preparation for every class; (2) punctuality in taking classes and not missing any; (2) perfect clarity in teaching with impressive handwriting on the board, especially of graphs and curves, lucid expression, and erudition with emphasis on recapitulation with illustrations and examples, to ensure that every last student understood the concepts; (3) always neatly dressed in a suit and academic demeanour; (4) a serious disposition, whether inside and outside the classroom.

Memorable teaching incidents

Teaching was Professor Ramanna's passion. He took it seriously, presenting himself as the best teacher in agricultural economics and motivating undergraduate students to pursue graduate studies in the discipline. Professor Ramanna would never miss undergraduate teaching as he strongly believed that it was there that he would mould the mind and attract the best talents at the postgraduate level. Professor Ramanna's erudite teaching with the simultaneous free-hand drawing of graphs and curves with ease, while students were still struggling to get the graphs right, was a usual experience. Graduate students took pride in being part of Professor Ramanna's department. Professor Ramanna used to often remark that the university is not built of bricks and mortar but of quality teachers, students, and researchers, and the students are the ambassadors of the university.

Professor Ramanna handled diverse courses, invariably commencing from the basic course Ag Econ 101: Introductory Agricultural Economics. He strongly believed that the introductory course has to be taught by the senior-most teacher. Every student considered it a rare privilege to attend the lecture and listen/learn in pin drop silence. Concerned about the status of the agricultural economics discipline in the country, one of the significant quotes for Professor Ramanna was that of Professor Ashby, Director, Institute for Research in Agricultural Economics, University of Oxford, who visited India in 1949–50, pertaining to the sad neglect of agricultural economics:

> Having regard to (a) the area of agricultural land, (b) the size of the agricultural population, (c) the importance of agriculture in the national economy its actual and potential contributions to national wealth I am appalled at the small provision made for investigation and research in Agricultural Economics … Recognizing that India is a relatively poor country, it is still true that in comparison with other applied sciences of agriculture, Agricultural Economics has been starved.

Professor Ramanna was responsible for the preparation of the background material and the syllabus for the BSc (Agricultural Marketing and Cooperation) degree programme for submission to Indian Council of Agricultural Research (ICAR) by Professor H.R. Arakeri, the then-vice chancellor.

Professor Ramanna never failed to invite prominent scholars for the benefit of students, for example, Professor Nimal Sanderatne, Professor of Agricultural Economics, University of Peradeniya, Srilanka; Professor G. Thimmaiah, Institute for Social and Economic Change; Professor C.H. Hanumantha Rao, Institute of Economic Growth; Professor Ram Iqbal Singh (CSUAT, Kanpur); Professor T.D.J. Nagabhushanam, APAU; Professor Hans Peter Binswanger, ICRISAT; Professor Glen Johnson, University of Michigan; and Professor Muraleedharan, Indian Agricultural Research Institute, New Delhi.

Seminar participation

Student seminar presentations drew full attendance as Professor Ramanna always conducted them himself with seriousness, making sure the students were well prepared. Discussion among the faculty and final remarks by Professor Ramanna were an academic treat. For postgraduate students, seminar presentations were treated with further seriousness, often more seriously than the regular classes.

Emphasis in different courses

Professor Ramanna used to impress upon students the importance of the two economic laws governing (a) production, i.e. the "Law of Diminishing Marginal Returns (LDMR)" and (b) consumption, i.e. the "Law of Diminishing Marginal Utility (LDMU)". While teaching LDMR, Professor Ramanna would explain: if, supposing the LDMR were not to operate, then it would mean practically that the entire world's production of any crop could be produced on just an acre of land by a farmer.

While teaching LDMU, Professor Ramanna would explain: if, supposing the LDMU were not to operate, then, if a consumer loves mango, it would mean practically that this consumer would always consume only mango for his/her whole life, without any other food preference. Farmers can always postpone LDMR with the injection of capital into farming.

Explaining the paradox of plenty and the Brannan Plan, Professor Ramanna emphasised that a good harvest does not necessarily ensure good total revenue as prices fall due to shifts in supply. Thus, the large output does not ensure large total revenue for the farmer and results in the inability of the farmer to adjust to changing price situations. Therefore Senator Brannan made a proposal to US Congress to make farm prices fully free, but provide cash subsidies to American farmers when prices were too low,

protecting farmers with assured or guaranteed prices for farm produce, while consumers enjoy the benefit of low farm prices and government makes up the difference. Professor Ramanna's famous quote in the course on "Economic Development" was "Poverty anywhere is a threat to Prosperity everywhere", and students would always remember this as a strong message to reckon with.

While discussing the Keynesian model of development, the Keynesian multiplier, Professor Ramanna used to explain why the Keynesian plant does not grow well in developing countries. Given K = the inverse of Marginal Propensity to Save (MPS) or (1 – MPC), the multiplier would increase with the MPC (Marginal Propensity to Consume). In developing countries like India, MPC is impressively high at 0.6 or above, i.e. out of every rupee added to income, more than 0.6 rupee or 60% is spent on additional consumption. The multiplier effect is not observable since the additional consumption due to additional income is made up of basic necessities such as basic or primary food articles, which do not generate as much income and employment as secondary processed food articles, as in developed countries.

Governance (administration – department, university)

Faculty recruitment, faculty capacity building, and encouragement to the young (students and faculty) were the hallmarks of Professor Ramanna's governance. His vision was to build a strong centre of excellence in agricultural economics at UAS (Bengaluru) and provide quality human resources outside (in India and globally). In his time there were 35 faculty in agricultural economics in different wings of the university. During the years of the inception of UAS, the official work day used to be either 8 am to 3 pm or 10 am to 5 pm. Professor Ramanna invariably used to come to the office at 8 am and return home by 6 pm, staying extra hours for the sake of the students, faculty, teaching, research, and administration. This meant he sacrificed time with his family and home-cooked food during the entire period of his service. Professor Ramanna, who was often invited to be an examiner or member of selection committees, would utilise his precious time during 2–3-day-long train journeys to correct/edit student theses and final drafts.

Professor Donald C. Taylor, associate of the Agricultural Development Council, USA, visited the department for three years from 1968 to 1971 and offered courses for the master's students. Professor R. Ramanna was responsible for recommending the names of faculty to Professor Donald C. Taylor, who provided opportunities to Sri J.V. Venkataram (in the University of Illinois, Urbana-Champaign), Sri N.S.P. Rebello (in the University of Tennessee, Knoxville), and Sri S. Bisaliah (in the University of Minnesota) to pursue PhD studies in the USA. Sri N. Karamathullah

proceeded to pursue a master's programme at the American University of Beirut. Sri K.C. Hiremath and Sri A.N. Krishnamurthy received sponsorship in the exchange program to carry on master's and doctoral studies in agricultural economics respectively at the University of Tennessee, Knoxville. The late Professor Rebellow contributed to production economics and monitoring and evaluation. Professor Venkataram contributed to the field of agricultural finance and cooperation. Dr Venkataram became the Director of Instruction of Post Graduate Studies at the university. Professor S. Bisaliah and Professor P.G. Chengappa occupied the position of vice chancellor of UAS Bangalore. Dr G.K. Hiremath became the first student to receive the ICAR Jr fellowship in agricultural economics. Dr Mruthyunjaya, the first rank holder in the bachelor's degree programme in agriculture from the Agriculture College and winner of the Jawaharlal Nehru Award for the best PhD thesis from ICAR, rose to the position of national director, NAIP, in ICAR. In 1987 Dr M.G. Chandrakanth was recommended by Professor Ramanna for training in forest resource economics at the University of California, Berkeley. Dr Chandrakanth became the first Indian to receive the Ciriacy-Wantrup Postdoctoral Fellowship at Berkeley (1988–90) and rose to the position of the director of the Institute for Social and Economic Change, Bangalore. Dr K.B. Umesh and Dr N. Nagaraj were recipients of the Jawaharlal Nehru Award for the best PhD thesis in agricultural economics. Professors K.G. Mallikarjunaiah, N.S.P. Rebellow, H.G. Shankaramurthy, G.S. Chandrashekhar, K.N. Ranganatha Sastry, C. Nanja Reddy, and G.K. Hiremath ably supported the department in teaching and research.

Research and guidance

Professor Ramanna's research guidance was largely to prepare good researchers rather than doing good research per se. His research contributions have largely been through the research guidance of his master's/doctoral students as he devoted his time, efforts, and energy to teaching and guidance, which was the need of the hour in the initial stages of building the department. The research focus can broadly be categorised into farm management, crop economics, economics of irrigation, macro-economic studies, and agricultural marketing. The empirical focus of all his research is on training the student in primary data collection from farmers in order that the student is able to pen their thesis with a palpable feeling of the grassroots circumstances. These studies also educate the reader regarding the economic historical situation of the time, largely during the Green Revolution period.

Macro-economic studies

The marginal propensity to consume for areca nut farmers of Karnataka was estimated at Re. 0.28 though small/large farmers spent 54%/32% of total consumption expenditure on food (Mruthyunjaya, 1972). A study on the performance of agriculture from 1955 to 1978 indicated that productivity-led growth was observed for major field crops of the state (Ranganatha Sastry, 1983).

Marketing

The study on the marketing of groundnut in the Raichur market indicated that farmers earned a substantial price advantage by selling the produce when there was a demand by storing groundnut for 1 to 4 months (Gurumallappa, 1972). The marketable surplus of food grains in the Tunga Bhadra Project area ranged from 5% to 37% of the production, and small farmers did not have any marketable surplus (Bylaiah, 1973). In the supply response of tea (Achoth, 1986), the area response indicated the asset fixity theory and while new planting displayed a positive response to price, replanting bore a negative relationship. The distributed lag model revealed that a "three year" delay was involved before farmers responded to price, in terms of the area. There was an asymmetric response of yield to price.

The business performance of the CAMPCO cooperative revealed that paid-up share capital, sales, owned funds, and fixed assets were promising and outstanding as compared with the general marketing cooperatives in India. The sound performance of CAMPCO with a high growth rate and the earning of the confidence of the areca nut growers are manifestations of the exemplary performance of CAMPCO Ltd. (Subba Rao, 1985).

Orange growers in Kodagu were not enthusiastic about the crop since only 30% of the coffee area was interplanted with oranges and due to the neglect of cultural requirements; low and uncertain prices were also responsible. Growers' share in the consumer rupee was around 50% (John D'Silva, 1979).

Farm management

In the dairy enterprise in the Bangalore District, the benefit-cost ratio and internal rate of return were 1.26 and 46.70% for cross-bred cows, while they were 0.91 and 4.72% for local cows and 1.01 and 16.29% for she-buffaloes. The cross-bred cows were more responsive to concentrates and roughages than local cows and she-buffaloes (Nagesh, 1980). A similar study in grapes indicated that the benefit-cost ratio and IRR were 1.42 and 40.97%

respectively for Bangalore Blue while they were 1.76 and 49% for the Anab-e-Shahi variety (Menon, 1978). In hybrid tomato, labour costs accounted for 30% of the cost of cultivation followed by fertilisers (26%) and plant protection chemicals (13%), and the productivity was 2.5 times higher than that of local tomato with a BC ratio of 2.2 (Basavaraja, 1980).

In silk cocoon production land, farm yard manure, fertilisers, number of irrigations, human labour, and other variable costs explained about 95% of the variations in the yield of mulberry crop, and land, fertiliser, and irrigation had significant elasticity of production (Murthy, 1977).

Yield gap analysis in ragi indicated that the experiment station yield was 28.80 quintals per hectare compared with 20.61 quintals per hectare on demonstration farms. The productivity on sample farms with HYV (High Yielding Varieties) was 10.50 quintals per hectare while the yield from local variety was 7.30 quintals per hectare. The yield gap I, between experiment station yield and demonstration farm yield, was 28.44% due to differing physical factors such as soil, climate, and related factors as well as management factors. The yield gap II, between demonstration farm yield and actual farm yield with HYV of ragi, was 50% due to bio-chemical and socio-economic constraints operating at the farm and/or village level. The yield gap III, between HYV and the local variety of ragi among farmers themselves, was around 30% and this was due to the adoption of HYV and differences in input use (Shivasubramanya, 1986).

Economics of irrigation

In the Tunga Bhadra Project command, roadside village farmers applied double the dose of nitrogen and phosphatic fertilisers, and realised 30% higher crop productivity and savings of 50% in the transport costs of inputs and produce compared with isolated village farmers (Nagarajappa, 1972). In the Malaprabha command area (Hiremath, 1973) income from crops formed more than 70% of total income on both irrigated and rainfed farms, with livestock yielding a minor source of income. The proportion of expenditure on food was more than 60% of the total, followed by clothing (12%), education (7%), transport (3 to 6%), and health (3%).

The first study on the comparative economics of borewell and open well irrigation in Koppal, North Karnataka (Kulkarni, 1976), revealed that the investment to sink a borewell along with the electrical installation was Rs. 20,429 (Rs. 7,634/ha) which at present (2022) costs at least Rs. 3 lakhs (a growth rate of 5.88% at current prices per year). The gross cropped area per farm was 5.25 acres with a benefit-cost ratio of 1.57 and a pay-back period of 2.31 years.

Similar work in the Eastern Dry Zone (Jayaraman, 1981) reflected the depth of borewells at 177 feet yielding water for 1,116 hours in a year with a total discharge of 1,882,992 gallons The depth of borewells has risen to 2,000 feet on average in the Eastern Dry Zone which is a compound growth rate of 6.09% per year.

A. Professor R. Ramanna at 80 in 2009. Source: M.G. Chandrakanth.

B. Professor R. Ramanna with Professor Hrabovsky of Agricultural Development Council, USA, at UAS Hebbal in 1970. Source: Professor R. Ramanna.

C. Professor R. Ramanna with Professor Arthur T. Mosher (author of *Getting Agriculture Moving*) in 1970. Source: Professor R. Ramanna.

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Dr Mruthyunjaya, Editor

Introduction

Accelerating growth and enhancing competitiveness of the agriculture sector in Karnataka

Mruthyunjaya

Karnataka is an important and beautiful state in the Indian Union. It is the sixth largest state by area, the eighth largest by population, the fourth largest economy in GDP, and the seventh largest in per capita GDP. It is blessed with luscious forests surrounding the state with hill stations, many historical artefacts, structures, and temples; a state with the perfect blend of globalisation with rich culture, traditions, and the virtues of our country, it is an ideal destination for tourists/visitors and is sometimes referred to as the Silicon Valley of India (*IT capital*).

Agriculture is the core sector of the state with a 14.7% contribution to state GDP and providing livelihoods to 68% of the population. It is the profession of 90% of the rural population and 85% of rural households. The average landholding size is 1.55 ha, and the average food production is 125 lakh tonnes, which forms 5% of the country's food production. Karnataka is a drought-prone state with nearly 70% of the area being rainfed/drought-prone. During 2015–16, annual per capita income from cultivation was 59%, and the remainder came from sources other than agriculture (14%), wages (6%), money transfers from outside (5%), business (7%), and government programmes (9%). It is a fact that farmers' income realised from crop cultivation is very low even under irrigated conditions, and it has been inconsistent over the years due to climate aberrations and product price fluctuations. A farmer's household cannot satisfy the family's consumption needs and other expenditures with this meagre income. It is a fact that, despite several reforms and policies made by successive governments in the past, as revealed in the studies in this volume, the overall performance of the state agricultural economy is a matter of deep concern. It is further stated that agricultural income does not fully support the livelihoods of farm families, particularly small and marginal ones (Nadakarni, 2018). The increasing cost of cultivation and the cost of marketing and trade infrastructure and logistics are not matched by an increase in output value due to market and trade failures; besides, inconsistent prices have contributed to this situation. To increase and sustain/stabilise the income of farmers, productivity growth

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