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A Study on Forage Crop Production - Past, Present and Future Agricultural Research and Extension in India

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An attempt has been made to study the forage crop production in the past, present and future agricultural research and extension in India. The health and productivity of livestock are closely linked with the quantum and quality of forage production. With lower human and livestock population in the past, the animals had accessibility to adequate quantity of forage, crop residues and concentrates. But now the scenario of forage production and utilisation presents a different picture. The gap between the supply and demand for good quality forage continues to widen owing to various constraints, viz., land and resource inputs. A small fraction of the cultivated area is under fodder crops. The study analyses the past efforts, present position and future thrusts on forage production in India. Owing to major emphasis on food crops, very little attention on research was paid in the past to the forage and fodder crops. In India, research on forages was initiated on a limited scale in Bombay (now Maharashtra) state towards the end of the 19th century followed by other states like Madras (now Tamil Nadu), Central State (now Madhya Pradesh), Bengal (now West Bengal) and Punjab. Later on, the Indian Council of Agricultural Research (ICAR) started financing fodder and pasture schemes sponsored by the states. In 1952-53, the ICAR accepted a comprehensive research scheme on grassland and fodder research in India as per the recommendations of Dr. R.O. Whyte, the FAO Advisor on grassland and fodder resources.

The key to successful development of an efficient forage production strategy involves two biological systems, viz., 'soil- plant' and 'plant-animal' in a dynamic manner. In this chain, the integration of ecological sustainability and technological developments is imperative to maintain high level of productivity without impairing soil environment. The integral systems of food-fodder production under dryland conditions such as intercropping, ratooning and overse grain crops with forage species mitigate shortage of feeds and fodder. Availability of quality seeds is a serious bottleneck for fodder production programmes. The forage varieties were earlier evolved for herbage production and as such by and large are shy seeders. Also, the forage crops are harvested as animal feed which precludes seed production. Moreover, the optimum ecological cumedaphic niches for seed setting of pasture crops are different than the main biological production. Forage production is a labour intensive venture. Thus, the question of its adoption particularly by the progressive farmers who rely on mechanised farming was being raised.

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The research programme in forage needs to integrate plant resources, livestock, the soil complex and the environmental management for productivity as well as sustainability. There is paramount need for increasing the plant genetic resources activities to broaden genetic diversity base in certain crops through exploration and collection, seed conservation, documentation etc. Special programmes for range grasses, legumes and MPTS needs to be devised. Technological modification is needed in perennial forage production systems with emphasis on nutritionally superior palatable species, crop geometry etc. to facilitate the use of farm machinery and rejuvenation techniques. The feasibility of growing forages in commercial crops based cropping systems, viz., sugarcane, potato, tobacco, cotton and fruit plantations requires greater attention. There is need to quantify the soil conserving, soil building and soil ameliorating values of forage grasses and/or legumes in problematic areas to restore land productivity and develop feed resources. Integrated use of low quantity roughages supplemented with green fodder, agricultural and other wastes, conserved and processed forages alongwith grazing and the use of shrub and tree leaves could provide balanced ration to animals. For this, a feeding calendar needs to be worked out for different regions. The socio-economic survey of pastoral communerative should form a regular feature of the programme to analyse the constraints in the development and implementation of technologies.

Impact of Research and Extension in Total Factor Productivity of Rice-Wheat System

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A study was undertaken to analyse the total factor productivity (TFP) of rice-wheat system at Farming System Research Center (FSRC), Jammu on the basis of time series data on inputs and output for a period of 25 years (1986-87 to 2010-11). The data collected from FSRC included time series data on output, i.e., production and prices and data on inputs, i.e., human labour, seeds, fertilisers, herbicide and irrigation. The results of the analysis indicated that for most of the years during last 25 years TFP exhibited to be less than one. Technical regression was found through the periods and also there were dwelling technologies. Most of the time period observed efficiency change and technical change less than one with the impact of efficiency change greater than technological changes. Except for treatment T_5 and T_6 during period V where they observed marginal increase, all other treatments observed decline in TFP during the entire period of the study.

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Chickpea Research and Extension in India: Achievements, Failures and Directions for Future

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Chickpea, the main pulse crop in India, accounts for 48 per cent of total pulse production. The paper critically analyses the achievements and failures of R & D efforts in chickpea at the national level and its impact on chickpea production and supply scenario and implications for food security and suggests policy measures for ensuring adequate nutritional security in India. Systematic and concerted research on chickpea was started with the establishment of the All India Co-ordinated Pulses Improvement Project (AICPIP) in 1967 with 12 centres located in the State Agricultural Universities (SAUs) with the headquarters at IARI, New Delhi which was later shifted to Kanpur in 1977 and was further upgraded as the Project Directorate on Pulses and Directorate of Pulses Research (DPR) in 1984. A separate AICRP on chickpea was started in 1993 with nine mandatory and 12 verifying centres and DPR was elevated as Indian Institute of Pulses Research (IIPR). At present, the research network on chickpea consists of one ICAR Research Institute, the IIPR at the national level and the 4 lead, 5 main and 15 sub-centres of AICRP on chickpea located at SAUs in all major chickpea producing states with around 200 scientific manpower exclusively working on chickpea research. Research efforts made in the past through NARS have led to release of more than 125 varieties, which are adapted to different agro-ecological zones and have the in-built capacity to tolerate some of the prevalent key biotic and abiotic stresses. The number of chickpea based cropping system have been identified which are most productive, remunerative and sustainable. Development of bio-intensive IPM technologies has helped reduce the intensity and frequency of key biotic stresses and reduction in the cost of production. The initial development focus was provided under National Pulses Development Project (NPDP) implemented during VII Five Year Plan and the establishment of Directorate of Pulses Development under the DAC. With a view to strengthen transfer of technology, a programme on frontline demonstrations on pulses was launched by Technology Mission on Oilseeds and Pulses (TMOP) during 1990-91, and NPDP was also brought under the purview of TMOP. Recently, the scheme has been transformed into a new mission mode programme ISOPOM. The study revealed that the declining trends in area under chickpea has been reversed since 2001 and it has increased by 4.02 million ha during last 10 years by registering a compound annual growth rate of 4.61 per cent. The total production of chickpea which registered a all time high level of 8.25 million tonnes in 2010-11 is still less than the total annual demand of chickpea in the country. The per capita availability of chickpea has also declined to 13.5 grams per day in 2010. Field Level

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Demonstrations (FLDs) have established that there was a yield advantage of 21-25 per cent over the local varieties every year. The mean yield of chickpea FLDs under improved management have been in the range of 13.57 to 16.17 qtls/ha. However, the yield levels obtained of improved chickpea varieties are either the same or even less as compared to those obtained (1588 kg/ha) 15 years back. Obviously, the improved technology has not been able to break the yield barrier in the yield levels achieved 15 years back. Fifty per cent of total FLDs conducted were meant for exploring the production potential of high yielding varieties (HYVs). The proportion of FLDs on package technology, fertiliser management, IPM including disease management was low ranging from 12 to 16 per cent. The FLDs on improved varieties are preferred as they are easy to implement. Other FLDs, though effective in yield enhancement such as use of sulphur application (yield level of 17.07 qtls/ha) but these need more components to be provided and monitored, hence, their numbers are very limited. The research system has to respond to the challenge of breaking yield barriers by developing HYVs well suited to local conditions. The extended extension capacity is needed beyond few research locations to conduct large scale FLDs by using the already established KVK network in almost every district. The emphasis in FLD design in IGP region should be prioritised towards the maintenance of fragility of the agro-ecosystem for pulse production.

Agriculture Extension – The Case of Agriclinics and Agribusiness Centres in Andhra Pradesh

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In India, the increase in agricultural production can be possible mainly from the growth in productivity which in turn depend on the intervention of agricultural extension activities in providing farmers information, training and support for adopting improved production technologies. In order to strengthen the extension services provided to the farmers and at the same time tap the potential of unemployed graduates, the scheme of 'Agri-clinics and Agri–business Centers' (ACABC) was launched on 9th April 2002. A study was conducted in Ranga Reddy and Mahbubnagar districts of Andhra Pradesh to analyse the status of entrepreneurship development under ACABC scheme and also assess the performance of units established in April 2002 under the scheme. The study relied on primary and secondary sources of data. Out of the 26 activities in which ventures are established, 11 agriprenuers covering 11 activities were included in the sample for detailed analysis. The units were categorised into five broad heads on the basis of the activities undertaken. These groups were agri business units (sale of fertilisers, insecticides, pesticides, seeds, etc.), agriclinics which provide consultancy services,

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tractors, dairy units and nurseries. Further, in order to study the views of the farmers on benefits accruing from these units, five farmers per agripreneur were contacted and their views on the importance, need and benefits accruing from the sample units were elicited. The field observations indicate that the training imparted to them has been very useful especially for preparing project reports, documentation procedure and other economic aspects of running an enterprise. A very significant number of villages and farmers are covered by the entrepreneurs. Though the other activities are taken up by the entrepreneurs, supplying of agricultural inputs along with it providing consultancy services inputs is found to be the major activity. A majority of them have availed bank finance from Bank of Baroda, Andhra Bank, Bank of India and Canara Bank to undertake sale/supply of inputs like seeds, fertilisers, power sprayers, power dusters, knapsack sprayers, etc. It is observed that the agripreneurs were able to attract farmers due to good quality inputs, expert advice provided to the farmers regarding proper use of inputs and free consultancy services. The agripreneurs who had set up dairy units were also carrying out processing and marketing activities apart from milk production. The extension efforts of the agripreneurs culminated in better awareness about the dairy practices, feed and fodder management and better production and price realisation. The agripreneurs were of the view that the agribusiness centers (input suppliers) have been successful in imparting knowledge to the farmers on the new and scientific methods of farming, thus leading to an increase in the production per hectare and the farm income. Apart from providing employment to agriculture graduates, the ventures set up by them have helped in providing gainful employment, both direct and indirect, to several people, depending on the nature of enterprise. On an average about 3 persons were employed under each enterprise. With the intervention of extension services of agriprenuers there has been improvement in the cropping patterns and thereby incomes of the farmers. Though, the objective of technology transfer has been met to some extent, yet there is a need to involve private extension staff in the entire production, processing, transporting and marketing chain. The farmers have received very little support in improving the marketing of their produce which needs to be enhanced by providing better market information to the farmers.

Impact of Public Sector Research and Extension on Backyard Poultry Production in Kumaon Hills - An Economic Analysis

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In India, poultry research, education and extension are conducted by the public, private funded institutions and NGOs. An attempt has been made to assess the

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economic impact of public funded research and extension for promotion of backyard rural poultry in Kumaon hills of Uttarakhand. For this purpose a sample of 90 poultry farmers, 18 contract chicks rearing farmers and 18 SHGs were selected from six villages of three selected districts, two blocks from each district selected randomly. The survey was conducted during the years 2011-12 and 2012-13 and information was obtained on various aspects of socio-economic parameters, constraints and problems in the adoption of improved genetic stock, diseases and poultry housing etc. The ICAR institutes and SAUs/SVUs have developed a number of elite coloured birds, housing and disease management techniques suitable for backyard poultry, Krishi Vigyan Kendras, demonstration and transferred the technologies to the farmers. The mother hatcheries supplied day old chicks to the NGOs/SHGs. The poultry breeds reared in the backyard were coloured birds and the most popular was Kroilers followed by Chabro, Central Avian Research Institute-Nirbhik and Vanraja. The economic analysis of backyard poultry systems revealed that on an average two batch of birds were reared annually and the additional family income generation per batch was ₹ 5440 and benefit-cost ratio was 2.94. Self consumption of poultry products added to the food and nutritional security at the household level. The impact of poultry research and extension was suppressed as the input supply and services delivery system was not well developed in Kumaon hills villages because of topographical problems. The government animal health care programme and para-vet staff of NGOs ignore backyard poultry for vaccination and other curative measures. This in turn led to high among birds' mortality and economic losses to the poultry farmers. The farmers opined that SHG women members should be trained for poultry housing management, vaccination and chick feeding/breeding to minimise mortality. They may be identified as para-vet resource person for the backyard poultry management and to sell near organic poultry products. The government should provide subsidy to the agencies involved in inputs supply and services for backyard poultry for sustained development of Kumaon hills. The inputs delivery should be strengthened for adoption of poultry technology package and promotion of rural poultry in Kumaon hills to fulfil the gaps in demand and supply at affordable prices. The study concluded that the backyard poultry farming in Kumaon region of Uttarakhand is quite successful and was in sync with the socio-economic status of the hill population which was resource poor. The economic impact of elite poultry production technologies and their adoption would be useful in addressing the issues of gender equity and women empowerment in Uttarakhand.

Performance and Emerging Challenges in Agricultural Extension: An Analysis

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In the wake of inadequate response of the public funded extension systems towards food security concerns, emerging technological changes in agriculture and structural adjustment process in the early 1990s, non-public agricultural extension systems gained increased focus. However, the alternate systems could not live up to the expectations in terms of coverage, delivery and inclusiveness. In this context, there is renewed interest on public extension system. This paper attempts to highlight the relevance of and trends in public extension system in India with the objectives of assessing the demanding factors for agricultural extension and analysing the human and financial resource position of extension system. The extension system in India has to confront issues of huge yield gap, proliferation of small holders and natural resources degradation. Notwithstanding the renewed interest in public agricultural extension system, human and financial resource allocation position of the system is quite disheartening. During the period between 1995-96 and 2004-05, the real extension expenditure has suffered a negative growth in case of crops and soil and water conservation activities resulting in negative growth in total expenditure. There is an immediate need to strengthen the extension services by scaling up investment levels and improving its quality. Inclusiveness of the extension services remain a major concern. Considering the prevalence and importance of small holders in Indian agriculture and the complexity of the problems confronting them, suitable extension strategies need to be formulated. The extension system has to be responsive to the needs of rainfed agriculture, tribal farmers and non-timber forest products, inland and marine fisheries, small ruminants like sheep and goat and natural resource sustainability. The challenges facing Indian agriculture are multitude in nature; and, therefore, an effective and inclusive extension system is a pre-condition for the overall growth. Development of such a system warrants an enabling and supportive policy environment. This requires infusion of financial and human capital to the public extension system. While there should be sufficient encouragement for non-public extension to grow and make their own presence, the public extension should be strengthened to cater to the scale and diversity.

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Engendering Agricultural Research and Extension: Public-Private Partnership Options

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Public-Private Partnerships (PPP) are inevitable in the face of declining public investments in agricultural sector and to attract private sector. The risky nature of agricultural sector and low incomes from agricultural sector are acting as deterrent for investments by the private sector. The PPP arrangements are instrumental to overcome these obstacles through arrangements like financial viability gap funding etc. by the public sector. These arrangements also create incentive structure for the private sector to increase efficiency in the service/goods delivery to the rural community in general and agricultural infrastructure in particular. The paper illustrates the current policy of government in PPPs in the agricultural sector, constraints in healthy development of the PPPs in agricultural sector and gives some policy suggestions.

Exploring Research and Extension Needs: A Study Based on Economic Analysis of Crop Production Technology and Output Risks of Major Crops Grown in the North Bank Plains Zone of Assam

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The study has analysed the extent of adoption gaps in terms of selected technology components, output risks and farmers' perception towards production constraints for important crops like, rice (both *sali* and *ahu*), wheat, rapeseed and mustard, jute and sugarcane under medium and lowland rainfed situations in the North Bank Plains Zone of Assam in order to explore further the research and extension needs. A detailed farm survey was conducted in two districts of the zone, viz., Sonitpur and Lakhimpur representing medium land and lowland rainfed crop situations. A total of 120 households, 60 from each crop situation, were selected to assess the output risks, technology, adoption gaps, production constraints of important crops pertaining to agricultural year 2011-12. The existing production systems of the crops indicate adoption gaps of significant quantum for various technology components suggested in the package of practices developed by the Assam Agricultural University and the State Department of Agriculture, Government of Assam. The study indicates research and extension needs based on farmers' perceptions. It was observed that if these gaps are minimised then there are

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possibilities of raising yields of *sali* rice by about 30 per cent and of *ahu* rice by about 37 per cent to reach the potential limit. On the whole for all the selected crops there are possibilities of yield enhancement by 28 per cent. By using the Cobb-Douglas production function, the variance-covariance matrices of output disturbances were estimated for the selected crop portfolio to assess the output risks. On the basis of estimated variances of output disturbances of the selected crops, *Sali* rice occupied the top spot followed by *ahu* rice and wheat. Loss of yield due to moisture stress during reproductive stage, occasional submergence of land due to heavy rainfall and pest and disease problems are the other major yield constraints in case of *sali* rice. Tiller mortality on submergence was also perceived by 32.50 per cent of farmers growing *sali* rice thereby indicating need for developing varieties with upright strong tillers.

In the case of *ahu* rice drought and moisture stress during seedling stage, pre-harvest sprouting of grain when pre-monsoon rain continue coinciding with the harvesting time of the crop and pest and disease problem were also perceived as important factors contributing towards yield loss. In the case of wheat pre-harvest sprouting of grains due to rains at harvesting time, moisture stress, nutrient deficiency syndrome, viz., yellowing syndrome due to phosphate deficiency were perceived as important research and extension needs. A problem of large scale false siliqua formation (24.89 per cent of oilseed producers) due to micronutrient deficiency syndrome is another yield reducing constraint in case of rapeseed. In case of jute important research thrusts should lay focus on dealing with pre mature flowering (perceived by 29.41 per cent of jute growers) and invention of low cost retting technique (perceived by 61.76 per cent of jute growers) for sustaining quality of jute fibre. In the case of sugarcane, profuse tillering and good ratooner varieties need to be developed. Non-availability of life saving irrigation is the major yield constraint in case of *sali* rice, *ahu* rice, wheat and oilseed crops. The expansion of area under wheat would be a positive step towards shift in the paddy-paddy dominant cropping systems to paddy-wheat cropping systems such as early ahu-sali rice-wheat provided life saving irrigation is ensured.