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Extension Management in Drylands under Climate Change Scenarios

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Abstract: In drylands of arid and semi-arid regions extension management is challenging task under climate change scenario. The brief accounts on technology development and dissemination since 1928 alongwith constraint issues for transferring like; technological, economical, socio-physiological, infrastructure at managerial, communicational, political are described. Professionalism particularly in dryland areas need more attention, where in parameter like work under complex and fluid situation, diagnose farmers' problem efficiently, learn from farmers, communicate efficiently and work with group of farmers. It can be enhanced through education and training where KVK have to play an important role to promote secondary agriculture for livelihood security with the cooperation of line departments. This may help in increasing the production and productivity of dryland areas.

Key words: Dryland, extension, climate, management.

The Indian economy is mainly dependent on agriculture, which contributes 15% of country's capital GDP and 60% employment potential. The concerted efforts in the form of green revolution and TAR have no doubt saved the country from starvation and have brought it to the level of food security. However, their benefits have largely been restricted to the better endowed areas inhabited by economically advantaged farmers of irrigated area. Ecologically disadvantaged areas (rainfed/drylands), having predominantly economically handicapped people, have not been benefitted much. Consequently, the already existing gap in the socio-economic situation between the two sub-sectors has further widened causing considerable socio-economic imbalance requiring urgent action for bridging this gap besides meeting the food and allied requirements of the burgeoning population. Rainfed agriculture occupies 65% of the net sown area, contributing 44% of food grain production supporting 40% of the population. Secondly, livestock forms an integral part of rainfed eco-system and two out of every three animals are thriving in these regions. These areas are spread out throughout the length and breadth of the country in arid, dry semi-arid, wet semi-arid and dry sub-humid regions. The National Commission on Agriculture in 1976 predicted that even when the full irrigation potential is tapped by 2010-2020 AD, over 50% of the arable land will continue to remain rainfed in the foreseeable future.

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Zone-VI comprising the Rajasthan, Gujarat and Union Territories namely Daman & Diu and Dadra & Nagar Haveli occupies 5.40 lakh sq. km area. Of this 52% area is under arid. Out of total arid area 60% is in Rajasthan and 20% is in Gujarat. On the whole arid and semi-arid areas together occupy around 75% of the total area. Climatically, the arid areas are vulnerable to various types of biotic and abiotic stresses often leading to drought.

Change in climate like cloud burst, drought, rise and fall in temperature, green house effects and global warming are some of the prominent factors influencing productivity and production of crops and livestock all over the world. The arid and semi-arid regions are facing the problem of climate change for more than 3500 years. The western districts of Rajasthan and Gujarat, once a part of Indus civilization, were granary of India due to better network of Sindhu River and its tributaries including Saraswati. Saraswati River vanished due to geo-morphological changes in Great Himalaya. CAZRI, Jodhpur, has well documented its path and hidden water bodies. Mahenjodaro and Harappa civilization spread over at Pilibanga in Hanumangarh, Dholveera in Kutch and Lothal in Khambat gulf of district Ahmedabad have been eloped due to floods followed by desertification led by climate change in these parts of the country. Climate change is not new for arid and semi-arid regions of Rajasthan and Gujarat as farmers of this region managed to cope up with drought situation for ages.

Farmers have developed various innovative time-tested techniques like khadin cultivation in Jaisalmer, sewan grass pasture, nadis for its people and important livestock breed like Tharparkar, Kankrej, Rathi, Nagauri, Gir, Jafradbadi (buffalo), goats, sheep and camels. Further continuous pressure of population accompanied by frequent droughts promoted cultivation of pearl millet, moth bean, mung bean and clusterbean which engulfed grazing lands.

The rainfed lands suffer from a number of bio-physical and socio-economic constraints which affect productivity of crops and livestock. These include low and erratic rainfall, land degradation and poor productivity (Abrol and Katyal, 1994), low level of input use and technology adoption, low draft power availability (Mayande and Katyal, 1996); inadequate fodder availability, low productive livestock (Singh, 1997) and resource poor farmers and inadequate credit availability.

After independence, various developments in agriculture sector changed the overall scenario of the country and these states have also made significant contribution in enhancing the agricultural production of the country. Groundwater exploration and use, dams and canal system helped in augmenting the production. As a result, decline in groundwater adversely affected production. At present arid and semi-arid parts of these states are facing lot of problems like low rainfall, climate change, frost damage in Rajasthan, land degradation, water logging, energy crisis, salinity and sodicity of soil and water.

The study 'Agriculture Towards 2000' by The Food and Agriculture Organization of the United Nations (FAO), Italy, clearly suggests that rainfed agriculture has tremendous potential and can help in feeding the world very easily by the use of improved technology including use of improved crop varieties, moderate use of fertilizers and adoption of soil and water conservation measures.

Efforts on Technology Development and Dissemination

The concern about the problems of rainfed areas has been expressed from time to time since the first Famine Commission and Royal Commission on Agriculture in India in 1928. The first attempt on dryland farming research was initiated on small scale at Manjri Farm near Pune (erstwhile Bombay now Maharashtra) in 1923. On realizing the vast problem of drylands Imperial (now Indian) Council of Agricultural Research started dryland research at 5 centers viz., Solapur, Bijapur, Hagari, Raipur and Rohtak which continued for a decade. In 1950, efforts were focused on soil conservation measures. Later, soil conservation in catchment of river valley projects was launched in 1962-63. The emphasis was given to prevention of soil erosion, siltation of reservoirs and flood control, whereas crop production was only secondary in importance.

Green revolution, a boon to Indian agriculture, created alarming disparity in the production and prosperity in irrigated and rainfed sectors of Indian agriculture. Later, ICAR formulated multidisciplinary project to espouse the cause of rainfed farmers. All India Coordinated Research Project for Dryland Agriculture (AICRPDA) was launched in 1970 with 23 cooperating centers. It dealt with two important factors; firstly need for location specificity in dryland research program due to high diversity in conditions and secondly, need for multidisciplinary approach for identification and analysis of problems and constraints limiting crop yields of rainfed areas. Later integrated Dryland Development Program (IDDP) was attached with AICRPDA for transferring the benefits of research to the farmers quickly and also to provide an opportunity to test the research results under actual farm conditions. The critical review of the project revealed that although the farmers adopted the improved technology during the project period, they reverted to their traditional systems as soon as the project moved only to an adjacent area (Friesen *et al*., 1982).

Later Indo-British operational Research Project (ORP) was implemented at Indore in 1974 and operated during VI five year plan. The major objective was to create better scientist-farmer linkages, to get feedback about the performance of research information and to have proper analysis of farm land constraints. Unfortunately these opportunities have not been fulfilled primarily due to non-involvement of farmers in the program leading to poor scientist-farmer linkages and also improper analysis of farm land constraints. In flood prone areas, ICAR launched watershed program in 1982-83 in 16 states with the Ministry of Agriculture of India and State Departments of Agriculture. Encouraged with the experience, Ministry of Agriculture started National Watershed Development Project for Rainfed Areas (NWDPRA) in 1990-91 for improving and stabilizing the quality of agriculture in rainfed areas. Concerted efforts on dryland agriculture research have generated number of technologies for the resource poor farmers of dryland areas viz., soil and rainwater conservation, timely planting of crops, adoption of improved and short duration cultivars, efficient crops and cropping system, farm implements, nutrient management, integrated pest management, alternate land use system (agro-forestry, agri-horti, silva-pastoral), integration of livestock with rainfed farming system, integration of the technologies through watershed approaches, resource conservation technique, integrated farming system, etc. (Venkateswarlu, 2000).

Krishi Vigyan Kendra is one of the unique systems all over the world under which agricultural extension by KVK have an important contribution to make. It is a grass root level organization that can help to fight poverty, to foster education of rural people, and promote behavior and technology that link high productivity with natural resource sustainability. Now, India has a total of 630 KVKs till date spread over in each district of the country.

Transfer of agricultural technologies, though appears simple theoretically, is in fact a very difficult task especially in the rainfed/dryland farming scenario with its complex diverse and risk prone nature (Chambers *et al.*, 1989).

The effective interface of the four main sub-systems namely research, extension, farmers and support on number of cognitive and logical factors that must be constantly monitored.

Constraints and Issues for Transferring Dryland Technologies

In this context, it seems relevant to take stock of various constraints, problems and issues that beset the dissemination of these technologies for increased productivity.

Technological

National Agricultural Research System (NARS) comprising ICAR institutes and SAUs have developed and demonstrated a number of technically sound and economically viable technologies in drylands. But the adoption of these technologies by the farmers has rather been extremely poor. This has been due to unsuitability of technology in the prevailing social, economic and cultural milieu of rainfed farmers which have been conspicuously missing in the technology generation mechanism. For example technology related to soil and water conservation, particularly farm pond, has very high initial cost, beyond the reach of farmer. So, it fails to click in the farming system of dryland areas. Similarly adoption of high yielding varieties/hybrids is very poor as it requires more attention towards biotic stresses and farmers perception that high yielding varieties are inferior in quality. The development of technology has not accounted two factors: (i) understanding farmer's management strategy in context of farming system, and (ii) blending of suitable technology packages appropriate for specific situation (compatibility and acceptance). Technological model developed under watershed development program has also not been harnessed fully. Because, the adaptive trials conducted at farmers field have ignored the problems, goals and expectations of dryland farmers. Hence, technologies developed have not been accepted by ecologically disadvantaged people. Thus, participatory research should be emphasized more and more in developing and disseminating more and more dryland technologies. So, research minded innovative farmers may be involved in the process of developing technologies in the cases of crop production and soil and water conservation.

Economic

Farmers prefer a technology, which is easily adoptable/feasible in their situation, involves low initial cost and capable of yielding good profit. Very few technologies qualify these criteria. Watershed management worked well initially, but once the financial support is withdrawn, the enthusiasm of the farmers in maintaining them in their own fields fizzles out as they find it difficult to maintain continuously season after season. Also, soil water conservation situation demands high initial investment which a typical dryland farmer cannot afford. Farmers' participation and involvement in a group as observed during pre-independence era for khadeen cultivation, grassland management, nadi/pond construction and social-agroforestry in arid areas are to be advocated as per local specific situation of dryland areas. Extension functionaries and farmers are to be trained by KVKs and leading NARS institutes and efforts are to be made in participatory mode including putting responsibility on the shoulder of farmers group.

Socio-psychological

A typical dryland farmer represents the poorest and most oppressed being in our country by virtue of his existence in a society that still remains feudalistic characteristics. Resource poor are unwilling to take risk. Extension professionals are forced to take a bias towards resource-rich farmers during their interface. These farmers are orthodox and have inherent reluctance to accept innovations. This is more so affected by male domination in decision making. The women folk are always deprived of involvement in decision making. Dryland farmers are reluctant to use chemical fertilizer with a fear that it burns the crop if no rain occurs during cropping period. Farmers are not motivated properly by extension personnel. The perceptions of personnel differ from the perception of farmers. So extension personnel are to be properly educated on problem and new techniques to guide and motivate farmers. Farmers, rural youth and farm women are to be trained on entrepreneurship establishment as drought proof mechanism for raising their income through self-employment. Farm women are to be educated and involved in all decision making processes to empower them socially. KVKs are doing this role, however participation of other developmental agency, private organization have to be encouraged.

Infrastructural

There is a paucity of field extension workers to cover large number of farmers in their jurisdiction. Efforts in this direction have to be made at the level of state government. NGO and private organizations have to be involved in such programs. Farmers of dryland areas face problems in marketing of their produce and also get less prices due to inadequate storage/ processing opportunities. All these sectors have to be taken care through market-led extension and establishment of entrepreneurship, etc. KVKs, ATMA, line department, development departments and NGOs have to join hand to assist the farmers. KVKs have to work as knowledge resource center in the district and provide technological backstopping to all stakeholders.

Managerial

Dryland farmers are poor managers due to illiteracy and lacking risk bearing nature. Farmers of Saurastra and arid regions have to sow the crops as and when monsoon rains are received. Farmers of Saurastra have to keep ready their fields before monsoon while the farmers of arid regions have to clear weeds and go for zero tillage sowing as and when rains are received. Custom hiring of machinery have to be encouraged to do timely sowing. When to weed and when to apply fertilizer are important aspects on which farmers have to be trained well in advance. Use of PRA is must to identify the resource poor farmers in dryland areas. Linkages between line departments, NGOs have to be strengthened to exchange and implement the knowledge at farmers' field.

Communicational

The information from NARS to the user does not reach timely. So efforts are to be made to enhance the skill of extension personnel for generating literature and communicating the information through group/mass contact, media, agro-advisory on mobile phone also. Such systems are taking shape with the help of KVK and some prominent NGOs. Modern tools can enhance the skill of extension personnel in disseminating the technologies at faster rate.

Political

Lack of constructive support of political institution in formulation, allocation and implementation of various schemes as well as day to day functioning of extension workers create problem in development of dryland agriculture. Responsible political systems have to encourage/motivate their respective departments and farmers by their frequent/ occasional visits. Also the decentralization, participation and bottom up approach have to be advocated frequently (Haug, 1999).

Need for New Professionalism

IVLP, TAR, assessment refinement and dissemination (by KVK), NATP, NAIP, RKVY are engaged in promoting professionalism in agriculture sector, but more emphasis has to be given in dryland areas by these programs. So it is more imperative to address following parameters viz., work under complex and fluid situation, diagnose farmer's problems effectively, listen to and learn from farmers, communicate efficiently and work with farmers and farmer groups. This kind of new professionalism can be imparted only through an education/training system that applies new insight from theory of learning. It is increasingly realized that technology transfer is not a passive process of farmers and other receiving new knowledge and skill from experts, but instead is an active process by which villagers search for and select their own technologies and practices (Dudley, 1993). Action-learning cycles using Critical Reflection on Experience (CRE) is very promising approach not only as an extension strategy, but also as an extension training methodology (King, 1998) to bring about new professionalism.

In view of the above, the dryland areas need more attention as affected by low and erratic rainfall and frequent droughts. Techniques like rain water harvesting have to be promoted through training and on-farm testing with the participation of farmers. Short duration pulses (kharif) have to be popularized by technological backstopping and front line demonstrations to meet pulse/protein requirement of the people. Coarse cereals and oilseed crops are to be linked with value added opportunity to enhance the income of farmers under secondary agriculture. Since livestock is the backbone of the dryland areas so more efforts are to be made on pasture development, feeding management and health care by KVKs and line departments jointly by integrating livestock with farming system. Women of dryland areas are highly backward due to lack of education and prevailing social systems. The women empowerment program through vocational training on agricultural practices and food/fruit processing, etc. are to be strengthened to bring them in the mainstream of development. All developmental, NARS and extension systems have to work jointly as FARMER is FIRST and we have to give him more importance to make himself sufficient in food production and income generation.

The major issues discussed above if taken care, will certainly help in increasing productivity of drylands. However, from time to time improvisation by planner, researcher and extension workers have to be done for the overall development of farmers in dryland areas to realize the fruits of second green revolution by dryland farmers.

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