A CRITICAL STUDY ON SUSTAINABLE COTTON FARMING AND ITS TECHNOLOGY TRANSFER PROCESS IN TAMIL NADU

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ABSTRACT

A study on sustainable cotton farming and its technology transfer process in Tamil Nadu was carried out with the following objectives i) to analyse long term trend in cotton area, production and productivity at world, national, State (Tamil Nadu) and ecosystem levels in Tamil Nadu ii) to find out the contribution of profile characteristics of farmers practising cotton farming in different ecosystems iii) to find out and compare the operating efficiency of the indicators/components of sustainable cotton farming in different ecosystems of Tamil Nadu IV) to study the information management pattern by farm scientists and extension personnel in sustainable cotton production technology transfer process and V) to undertake constraint analysis as expressed by farm scientists, extension personnel and farmers on sustainable cotton farming and its technology transfer process.

During the period from 1970-71 to 1996-97 growth in production and productivity was spectacular at world and national levels though the area remained almost static. In Tamil Nadu the area was found to decline during the above period with marginal increase in production due to high growth rate in productivity. Similar trend was registered both under winter irrigated and summer irrigated long duration rice-fallow ecosystems whereas the decline in area under rainfed system was more than compensated by increased production and productivity.
In contrast summer irrigated cotton succeeding groundnut/sugarcane, short duration rice-fallow and cotton intercropped with groundnut systems had increased growth rates in area, production and productivity.

Of the 25 profile characteristics of cotton farmers studied in each ecosystem with the dependent variable ‘sustainable cotton farming’, 14 variables viz., educational status, nature of family, farm size, annual income, implements and appliances status, material status, cotton farming intensity, outstanding credit, achievement motivation, level of aspiration, innovativeness, extension system link, research system link and socio-economic status had significant difference between systems.

Farmers belonging to winter irrigated system had relatively high profile in respect of all the above 14 variables followed by winter rainfed system as compared to the remaining four systems. However high outstanding credit, low level of aspiration, extension and research system link were some of the unfavourable factors in the rainfed system.

Farmers of cotton intercropped with groundnut, summer irrigated cotton succeeding groundnut/sugarcane and short duration rice-fallow cotton systems were largely similar in their profile status with small farm size, inadequate access to implements and appliances, low level of aspiration and poor socio-economic conditions.

In contrast the farmers of summer irrigated long duration rice-fallow system were relatively placed in a most disadvantageous position due to poor educational status, more number of family members, small farm size, low annual income, poor accessibility of farm implements and appliances, low material status, low level of achievement motivation and innovativeness, inadequate research system link and relatively low socio-economic status. Thus it appeared that the farmers belonging to systems having weak socio-economic conditions, inadequate infrastructure facilities like implements and appliances, material possession, credit facilities etc, need further upliftments.

On critical scrutiny of correlation, regression and step-up analyses of farmers’ personal profiles with sustainable cotton farming revealed that cotton farming experience, community co-operation, economic motivation, farming commitment and extension system link had positive influence on sustainability in the study area.

Comparing the systems 12 characters viz., educational status, occupational status, innovativeness, economic motivation, value orientation, attitude towards sustainable farming, farming commitment, extension system link and community co-operation had distinct positive role in their impact on the dependent variable under winter rainfed cotton.

Variables nature of family, achievement motivation, level of aspiration, economic motivation and research system link in winter irrigated, attitude towards sustainable farming, occupational status and cotton farming experience in summer irrigated cotton succeeding groundnut/sugarcane, extension system link and research system link in summer irrigated
long duration rice-fallow, farming commitment and extension system link in summer irrigated short duration rice-fallow and achievement motivation, farming commitment, community cooperation and cotton farming experience were the outstanding factors positively influenced sustainability.

It could therefore be generally inferred that personal, situational, psychological and communication factors of farmers did play key roles in practising sustainable farming.

Relationship of farmers’ profiles with components/indicators of sustainability derived through groupings into three Principal Components (PC) comprising Integrated Pest Management, water management, environmental soundness, input self sufficiency and stability under PC-I, productivity, infrastructure accessibility, Integrated Nutrient Management, government policies and marketability in PC-II and technological appropriability, decision making pattern, information self-reliance and output-input ratio in PC-III supported by latent vectors of the component variances, revealed that seven factors namely educational status, level of aspiration, innovativeness, farming commitment, research system link, community co-operation and socio-economic status influenced either any one or more of the components in the study area.

Comparing the systems it was observed that the impact of profile characteristics on sustainability components varied prominently between components and systems. For instance favourable influence of cotton farming intensity and attitude towards sustainable farming on PC-I in winter rainfed system was evident. Community co-operation had negative effect on PC-II in summer irrigated cotton succeeding groundnut/sugarcane implying lack of group action in enhancing productivity, infrastructure facilities, Integrated Nutrient Management, implementing government policies and market facilities. The negative impact of family education in PC-I under summer irrigated cotton succeeding groundnut/sugarcane might be due inadequate adoption of Integrated Pest Management and water management practices causing degradation in environment and instability in yield in addition to over dependence on external inputs. Farmers’ age in PC-I and level of aspiration in PC-III had shown favourable impact under summer irrigated long duration rice-fallow system. In short duration rice-fallow, farming commitment had positive response whereas the extension system link had negative influence on PC-III implying the need for strengthening technology transfer process to enhance information self-reliance and to produce economic returns through timely decision on production management.

In the study area over 60 per cent of farmers represented medium level of sustainability with almost equal distribution of low and high categories in both study area and systems suggesting ample scope for enhancing the overall sustainability.

An analysis of sustainability and its principal components disclosed that all systems except winter irrigated had significantly high indices,

Critical analysis of indicators revealed that productivity, government policies and marketability in winter irrigated system, infrastructure accessibility in summer irrigated long duration rice-fallow system, technological appropriability and output-input ratio, environmental
soundness and stability in winter rainfed system, water management in summer irrigated short
duration rice-fallow system, Integrated Pest Management, environmental soundness, input self
sufficiency and stability in summer irrigated cotton succeeding groundnut/sugarcane and
Integrated Pest Management, environmental soundness, input self sufficiency and Integrated
Nutrient Management in cotton intercropped with groundnut had significantly high indices
denoting their better operational effects on sustainable farming. Further information self-reliance
had positive gain in its functional effect in all systems.

Studies on correlation and regression of indicators with sustainability in the study area
further revealed that technological appropriability, government policies and environmental
soundness had favourable effects whereas the effect appeared to be negative in case of water
management.

The operational efficiency of various indicators under different systems revealed that:

Technological appropriability was found to work more efficiently in winter rainfed and
summer irrigated short duration rice-fallow than in other systems.

Integrated nutrient management was found to show positive influence in summer irrigated
cotton succeeding groundnut/sugarcane whereas it was reverse in winter irrigated and rainfed
systems.

Integrated pest management (IPM) had shown marginal impact in all systems except in
cotton intercropped with groundnut where it was found to be ineffective to promote sustainability.

Information self-reliance was found to be inadequate in winter rainfed and summer
irrigated cotton succeeding groundnut/sugarcane systems.

Marketability was favourable in cotton intercropped with groundnut while it was not
beneficial in summer irrigated short duration rice-fallow system.

Water management practices appeared to be ineffective on sustainability in summer
irrigated cotton succeeding groundnut/sugarcane and cotton intercropped with groundnut
systems.

Output:input ratio had positive trend in all systems except in summer irrigated long
duration rice-fallow and winter rainfed systems where the outputs were relatively less.

All systems generally exhibited favourable trend in productivity.

Stability (measured on realised yield in proportion to expected yield) was found
favourable in all systems except in summer irrigated long duration rice-fallow where yield
fluctuations were high.
Use of own resources (input self-sufficiency) was found to be more by farmers in all systems except in summer irrigated cotton succeeding groundnut/sugarcane wherein the farmers were mostly depending on purchased input.

The environmental conditions in different ecosystems had no adverse effects due to the adoption of sustainable cotton farming technology.

The ability of cotton farmers to possess information required for sustainable cotton farming and utilising them for decision making was not adequate in winter rainfed and summer irrigated cotton succeeding groundnut/sugarcane systems.

The existing decision making pattern of farmers did not make any change on sustainability.

Infrastructure accessibility through institutions or organisations providing physical and capital resources including transport and services did not make any influence on sustainability in all systems.

Policy environment created by governments on issues related to cotton production through various acts, legislation, cotton export and import policies etc, had positive impact on sustainable cotton farming in the study area and in summer irrigated cotton succeeding groundnut/sugarcane and summer irrigated short duration rice-fallow systems.

The reasons for differential effects of these indicators could be attributed to adoption pattern and heterogeneity in profile characteristics of farmers within the carrying capacity of the system concerned. It could also be inferred that all the systems were sustainable with reasonable levels of productivity within the carrying capacity of the system concerned. By use of ecosystem specific technology and its efficient transfer and effective adoption, it is possible to achieve sustainable growth in cotton output in the immediate future.

The subjective assessment of technology management pattern on sustainable cotton production and its transfer process by farm scientists and extension personnel revealed that information input, processing and output pattern were relatively adequate for technology development and transfer process in the study area. However, farm scientists expressed that though they received feedback at expected level from farmers, it was relatively less from extension personnel which could be improved by still closer interaction between them to diagnose actual field problems in adoption of technology and find solutions. Majority of scientists also opined that farmers should be intensively educated through training on the optimal use of natural resources integrating with pest and nutrient management in the production technology and conducting frontline and on-farm demonstrations in large scale in collaboration with extension personnel and farmers to identify constraints in productivity under different ecosystems through
feed back mechanism and finding Solutions. Extension personnel while endorsing the above views also suggested for developing location specific varieties/hybrids with pest and disease resistance and enhanced sustainable production technologies. Majority of them felt that technological upgradation in integrated pest and nutrient management, implements and appliances, irrigation management, crop rotation etc., were needed for location specific recommendations particularly in rainfed ecosystem, besides intensive training and demonstrations to farmers, conduct of large-scale demonstrations in farmers’ fields, village adoption and extensive use of mass media and favourable government policies on providing separate extension personnel for intensive field work, supply of quality inputs, organised marketing and pricing and EXIM policy to promote sustainable cotton farming.

Analysis on constraints faced by scientists, extension personnel and cotton farmers for suitable cotton growth revealed interesting observations. Majority of scientist had confessed that the existing production technologies were not adequate for sustainable development. Constraints from inadequate financial resource, infrastructure facilities such as precision equipment, laboratory equipment, accessibility to electronic media such as computer, E-mail, internet, etc., on international cotton literature, unwillingness of farmers to extend co-operation for conducting field trials and demonstrations and inadequate manpower for effective execution of field work often hindered technology development by scientists.

Constraints such as shortage of qualified technical personnel in the organisation, strained relationship among functionaries, delay in release of funds, insufficient training, lack of training aids and lack of efficiency in project management were reported to be some of the bottlenecks encountered by extension personnel in technology transfer process.

In addition to bio-physical, input and infrastructure and socio-economic constraints from climate, soil, drought, pests, diseases, weeds, substandard inputs, power, high wages and input costs, low remuneration, lack of credit and market facilities, etc., farmers were also encountered with technological and communicational problems. Resurgence of pests, complicated process involved in field application of technologies, heavy fertiliser requirement, inadequate knowledge and skill in field application were reported to be some of the technological problems faced by farmers. Communicational constraints like lack of advice, guidance, inadequate exposure to technology etc., were also reported. These technological and communicational constraints could be remedied through concerted efforts of scientists and extension personnel. Few implications arising from the present study were also suggested for consideration of policy makers, administrators, extension personnel and researchers to attain sustainable accelerated growth and development in cotton.