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The Bangladesh Rural Development Studies. Vol. V. No. 1 & 2 (1995)

Institutional Structure and Social Forestry Development Programme in Bangladesh

Dr. Ashrafuddin Ahmed*

Abstract

Social Forestry has evolved, during the last few years, as an alternative approach to the traditional forest resources development practice in Bangladesh. In this article, arguments and facts have been put forwarded and analysed in justification of the assumption that in Bangladesh social forestry offers a practicable solution to many problems ranging for growing additional food-grains, finding alternative sources of nutritional diets, energy, fooder, timber and building materials, social and economic rehabilitation of landless and marginal farmers and rural women to the forging of an ecological balance among men, land and trees. The paper strongly argues that the above goals can be realistically achieved only when there exists a participatory institutional mechanism involving government, people's organization, research, training and extension institutions and above all, the beneficiaries. Efforts have been made to show that inspite of the government's declared goals, as reflected in the Second and Third Five Year Plan documents, achievements fell far short of expectations and set targets because of the faulty institutional structure in the management of social forestry projects. Democratic decision-making, participatory planning and people-centred institutional structure in place of the present bureaucratically structured conventional forest administration is the need of the hour for the success of social forestry programmes in Bangladesh. If the enthusiasm of the regime in power, the rural people and the research and training institutes as well as the NGOs can be institutionalized through the structure indicated above, Bangladesh, in the near future, can be expected to become an example of successful case in social forestry programme in the world.

Introduction

Social forestry denotes an array of possible forestry applications in settled areas or in locations outside the government administered forest lands. It has evolved as an 'alternative' approach to forest resources development over the past two decades. It is now widely believed that social forestry offers a partial solution to many problems ranging from growing additional food-grains, finding alternative sources of nutritional diets, energy, fodder, timber and building materials, rehabilitation of

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less-fortunate groups of human beings to the forging of an ecological balance among men, land and trees. It is often argued that in the face of growing landlessness among rural population over much of the developing world, the use of tress to stabilize steep hill sides, to control erosion, to meet fuel-wood needs and above all, to provide sources for additional income and employment must be encouraged through socially rehabilitating the poor people for their economic emancipation. (Bruce et.al,1985. p.vii). This realization has led to the initiation and undertaking of social forestry projects by many national governments. International development and donor agencies as well as non-government organizations and community-based organizations are also showing keen interests in social forestry.

Background Information

Schumacher, in his Small is Beautiful, has traced a direct link between "the land use pattern of a nation" and "the state of development of a society and so also its future" (Schummacher, 1977. p.288). A grim picture of the state of development and future of Bangladesh society and economy can be obtained from the fact that the nation is currently facing an acute shortage of fuelwood, timber and bamboo supply caused by widening of gap between diminishing supply and increasing demand. The circumstances that has led to this worsening state of affairs is not difficult to identify.

Bangladesh has only 3.9 million acres of forest land. With only 0.03 acres of forest land per head, the nation falls far below the world average of 2.6 acres. Consequently, the country's forest resources can neither meet the fuel wood and timber needs of over 110 million people, nor it is enough to check soil erosion, denudation and degradation of land and thereby preserve ecological balance. Government administered forests can produce only 10 percent of the fuel wood and bamboo and 30 percent of the timber requirements of the country. From an ecological perspective, with only 9 percent of the total land area of the country under forest-cover by government programmes, Bangladesh can hardly expect to protect her environment through enriching and conserving nature following conventional approach of forest management and development. (BBS, 1985, pp.162-200).

Social Forestry in Bangladesh

Social forestry as an ' alternative approach' to rural development was first mooted in Bangladesh by few individuals. The Betagi-Pomora experiments in Chittagong launched at the initiative of Prof. Alim and his handful of associates heralded the beginning of social forestry in Bangladesh. (Ahmed, 1988a). The government recognised social forestry as an approach worth trying for forest resources development in the country and accordingly made provisions for few projects in the Second Five Year Plan (1980-85). The results have been a mixed one with certain

projects showing brighter results while others faultering because of unsound institutional structures and management problems.

Institutional Structure of Government Administered Social Forestry

The Second Five Year Plan (1980-85), for the first time in Bangladesh, incorporated a massive programme on social or community forestry. Funded by UNDP and ADB, the project 'Community Forestry Project-1' was made operational in June 1982 with a total allocation of Tk. 26.36 crores. Seven old districts of the North-Western part of Bangladesh in the deforested Barind region (Rajshahi, Rangpur, Dinajpur, Pabna, Bogra, Kushtia and Jessore) were brought under the project. The objectives were to:

a) improve land use practice;

b) conserve soil and water;

c) Increase bio-mass fuels and utility timber;

d) encourage tree plantations on marginal land and homestead;

e) create employment opportunities for landless and marginal agricultural farmers

f) develop community awareness among the villagers and enlist their participation in the efforts for community forestry; and

g) create a permanent institutional capacity for forestry extension services.

Core activities included

i) Replenishment of depleted homestead wood lots in 4,6500 villages;

ii) Establishment of 19 new and rehabilitation of 21 existing Community Forestry Growth Centres;

iii) Establishment of (a) strip plantations along highways, railway lines, miles, (b) fuelwood plantations on 12,000 acres of government forest land, canal banks, Zila, Thana and Union Parishad roads totaling about 3000 and (c) agro-forestry plantation in 300 acres for demonstration purposes;

iv) Institutional support by way of staff training and exposures to the use of equipment (for xtension and training) to the forest training schools; and

v) Providing consultancy support. (GOB, 1990).

End Results

The project continued for six years as per the provisions of the agreement between the Government of Bangladesh and the Asian Development Bank. In various evaluation reports prepared by the government as well as individual researchers, what transpires most prominently is that the project could not enthuse people to actively participate in it. The Third Five Year Plan document observes that:

> ***Because of the energy crisis, rural forests suffered heavy toll leading to serious ecological problem between land and nature. So, during the Second Plan, great emphasis was laid on the development of rural/village forestry. The target of raising plantation in 7,200 acres of degraded government forest land was achieved, but the vitally important factor, i.e., participation of people was lacking. The strip plantation programme was not very successful because of lack of participation of local people (GOB, 1985).***

To overcome the problem that emanated from lack of people's participation in social forestry, the Third Five Year Plan advocated a different strategy. The following were the major ones: (a) pursuing the programme for community participation; (b) invigorating the extension work by the agents of the Department of Forestry; (c) expansion of the programme for nurseries, distribution of saplings of fruit trees and short cycle trees; (d) plantation in vacant Khas land by the side of railways, roads, canals and other public places; (e) plantation in degraded Khas and unclassed state forest lands through encouraging group actions of landless and marginal farmers; and (f) establishing a separate wing for social forestry within the Forest Department. (GPRB, 1990).

Unfortunately, however, many of the objectives set out for the Third Five Year Plan could not be achieved. Of the total allocation of Taka 230.46 crore provided through the ADPs only about 52 percent could be utilized. Only 18 projects, of which 11 were spill-over from the previous five year plan period, out of total of 24 ear-marked for the Third Five Year Plan could be implemented. The Fourth Five Year Plan ascribes the reasons for this shortfall to the following factors:

i) non-availability of funds;

ii) failure in designing appropriate projects; and

iii) Non-availability of foreign assistance, etc.

The management and funding problems were so acute that out of the 18 projects 14 could be completed and the rest 4 had to be spill-over to the Fourth Plan. (Ibid).

The Fourth Five Year Plan emphasised the need for expansion of the tree-cover area of the country so that supply of forest products as well as overall environmental condition of the country could be improved. This was identified as one of the overriding goals of the plan. As many as six broad objectives were identified to achieve the above goal. These were:

i) to rehabilitate or reafforest the denuded and degraded national forest land;

ii) to bring all possible vacant public and private lands under tree cover;

iii) to meet basic needs of all forest products by integrating trees with farming and traditional land-use;

iv) to improve the general environment for supporting agricultural and other biological production;

v) to create employment opportunities for the landless poor, marginal farmers and women; and

vi) to adopt different wood conservation techniques. (Ibid. P.V.E-1-7).

The institutional strategy advocated in the plan included increased organizational and management capabilities in planning, implementation and maintenance of projects through training, research/extension and better management of existing forest lands through protection and reafforestation with due emphasis on short and long rotation indigenous and exotic species as well as development of agro-forestry in encroached/denuded forest lands through emphasis on social organization.

New Institutional Approach to Social Forestry

The Fourth Five Year Plan is distinctive in the sense that it endeavored to design and implement a new approach to social forestry somewhat different from the approaches adopted in the earlier plans. Thus, instead of social/community forestry, 'rural forestry' has been used to denote a wide array of activities ranging from homestead forestry to strip planation along river and canal banks, road sides and government land, in and around educational institutions and in fallow or Khas land. Both informal and formal group approaches involving different village groups, especially the landless and marginal farmers and women through participatory and benefit-sharing arrangements have been highlighted in the plan. A target for distributing 15 million saplings to public and a programme for intensive planting in 10,000 villages was set in the plan. A massive plan for a total of 25,000 km and 40,000 ha of plantations on vacant Charlands (accreted land) was to be implemented. In addition, plantation was planned in the vacant premises of 10,000 educational and religious institutions (Ibid).

Concluding Remarks

The institutional structure for realizing the above strategies and programmes for farm forestry, wood lots, strip plantation and homestead forestry, however, remained bureaucratically structured as per the conventional forestry administration. Democratic decision making, participatory planning or people-centred social forestry programmes remained utopian to the policy planners. Though they were advocating social forestry through people's participation, a bureaucratic reorientation to break open the bureaucratic resistance to change was yet to take a firm root. Resultantly, social forestry remained a bureaucratically dominated realm much the same way as the government administered forests.

Inspite of the above realities obtainable in the formal institutional system of the government forest sector, laudable political commitment of the regime in power and the efforts of institutions like Rural Development Academy, Bogra, different NGOs and the private sector have worked together to take social/community forestry very near to a movement. There may be reasons to cast doubt on the achievement of the Department of Forest in realization of the set targets but the number of trees planted in the rural areas of the country through the initiatives other than the department have been phenomenal. If the trends continue, Bangladesh, in near future, can become an example of successful case in social/community forestry programme.

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Tagore's Approach to Rural Reconstruction : Its Relevance in the Present Time

Nurul Islam[1]
Niaz Ahmed Khan[2]

Abstract

The paper illuminates the works of Rabindranath Tagore, the legend, as a rural reformist and development thinker. It highlights the socio-political milieu in which Tagore's ideas assumed concrete shape and his approach and performance of rural reconstruction. A comparative account of the philosophy and practice of rural reform between Tagore and those of another illustrious Indian philosopher, M. K. Ghandi, has been preferred. Finally, it traces the relevance of Tagore's ideas and practices in the present time. The paper argues that Tagore's ideas, especially his advocacy in favour of a non-bureaucratic, pro-societal and people-oriented comprehensive approach to rural reconstruction, are in splendid conformity with the current development pursuits in this region.

Prologue

The late nineteenth and early twentieth centuries witnessed a massive upsurge of nationalist revival in the British India. Like many other nationalists of his time, Rabindranath Tagore (1861-1941) also had a burning zeal to free his motherland from the colonial bondage and develop it in the light of her own indigenous tradition. The nationalists, Tagore included, who were a product of the modern education system, used a common technique of glorifying India's own past to mobilize the people, mainly to unite them against the colonial power. They intensified their struggle against the colonial rule through various symbols, movements and actions. Tagore's participation in the nationalist movements, however, was distinct in many ways.

This paper will attempt to highlight the socio-political milieu in which Tagore's ideas took shape, major ideas and efforts in his rural reconstruction, differences of his efforts from another leading nationalist of his time, M. K. Gandhi, who left a deep imprint in the minds of Indians as well as in the history of thought and village development. Finally, some observations will be made about the relevance of Tagore's ideas and works at the present time.

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Tagore and the Swadeshi (Home Rule) Movement

Tagore, born in 1861 of a renowned Bengal family, was always inspired by the rich heritage of India. Immediately after his return home from his second visit to England, Tagore was asked by his father to look after his ancestral Zamindari (land estates) in the districts of East and Northern Bengal and Orissa. He honored his father's wishes. Direct involvement with the Zamindari gave the poet an unique chance to be closely familiar with the lives of villages (Stephen, 1970, p.31). Gradually Tagore became so attracted to the peace and charm of village life that he preferred to live in Santiniketan (abode of peace), a rural retreat of his father, Zamindar Debendranath. He secured permission from his father to settle at Santiniketan, ninety miles north of Calcutta (Ibid. p.38).

In 1901 Tagore started a school at Santiniketan for boys (Ibid.). However, he had a dream of a bigger school, which came true at a later stage when he founded a World University (Visva Bharati) at Santiniketan. Visva Bharati was meant for the entire humanity with a purpose to bringing the East and the West together. The project was undertaken in 1918 and the University was inaugurated in 1921 (Banerjee, 1971, pp.146-147). His efforts at promoting international understanding, however, did not make him forget his obligations to the rural people of India. As Tagore was very sympathetic to the cause of villagers, he wanted to do something meaningful for them. The establishment of a rural welfare section in his University which later on came to be known as 'Sriniketan (abode of wealth) symbolises his love for the rural people. More discussions on Sriniketan will follow in an appropriate section below.

Though basically a poet, Tagore was not detached from politics. Instances of Tagore's involvement in political movements are many. Of them, perhaps the most illustrious example is his involvement in the Swadeshi Samaj (Home Rule) movement, which took shape in the British India in the early twentieth century. Another important example could be his resignation from the 'knighthood' offered to him by the British crown in 1913, as a protest against the massacre of Indians who were protesting at Amritsar against the British rule in India. Here we will be concerned with only one aspect of his political involvement, that is, his role in the Swadeshi Samaj movement.

The Swadeshi movement was a manifestation of the growing consciousness among Indians to determine and control the political destiny of their own country. The British, however, were very slow in responding to the nationalist demands and, in many cases, they just ignored the Indian sentiment. This slow response and, in some cases, non-compliance to the nationalist demands further spurred the movement. Being disappointed by the British policies, the nationalists began to search for alternative institutions, suited to India's needs. They became interested in indigenous, Asian, and Continental European sources, as a reaction to the British policies (Leonard, 1974, p.77).

Tagore was an ardent believer of Swadeshi Samaj. He believed that the real Swadeshi Samaj is possible only through the development of villages. because "For him village work was the real work and without it such high sounding phrases as home rule. autonomy, etc. appeared to be ridiculous" (Pande. 1967. p.88). His conviction became firmer as time went by and by his 40th birthday. Tagore's position on his preference for peaceful village development became more distinct (Stephen. op. cit. p.32). This special concern for the development of village life as a way of making India free. in the real sense of the term. has made his approach different from many other thinkers. Tagore not only appealed to political leaders to undertake village works side by side their political works. but he himself came forward to undertake such actions.

Tagore's Approach to Rural Reconstruction

Tagore seems to be more pro-society than the pro-state in his approach to the development in general and to rural development in particular. The reason for his preference for society over the state was that it was. to him. more in keeping with the Indian tradition. Also, his perceived solution to the emancipation of the rural masses was a comprehensive one; it included the transformation of the entire society. In his opinion, mere political independence was not enough for the realization of the home rule; it was a necessary though not the sufficient condition (Leonard. op.cit. pp.77-78). Real emancipation is possible only if it encompasses the entire society. He believed this to be true not only for India. but the rest of the world as well. In Tagore's own words:

> *Our real problem in India is not political. It is social. This is a condition not only prevailing in India, but among all nations. I do not believe in an exclusive political interest (Tagore. 1917. p.97).*

Tagore also believed that true development of human beings is possible in a atmosphere of co-operation, not coercion. The state was. therefore. considered unsuitable for the above purpose by Tagore because of its frequent reliance on the coercive force. He made his preference clear for the societal solution to the issue of the development of human beings as well.

Tagore was in favour of helping the villagers in forming their own groups and to solve their own problems, not to impose any solutions on them. Thus the poet wanted to train through Sriniketan a group of workers. who could be models to villagers.

Experiments with Rural Reconstruction

The establishment of the Sriniketan (abode of progress), by the side of the Santiniketan (abode of peace), marked the beginning of a new education system in India. Tagore explained the objectives of the Sriniketan in the following words:

(i) to win the friendship and affection of the villagers by taking a real interest in all that concerns their life and welfare and by making a lively effort to assist them in solving their problems;

(ii) to understand the "villages" daily routine and the varied pageant of his life;

(iii) to form a picture of the village of its outward form and its inner story in order to bring home them the benefits of associate life, mutual aid and common endeavour (Dasgupta, 1968, p.4).

In order to achieve the objectives, the poet felt that a scientific approach was necessary to stimulate initiatives of villagers and encourage them to undertake experiments. In the words of the poet:

> *Sriniketan should be able to provide for its pupils an atmosphere of rational thinking and behaviour, which alone can save them from stupid bigotry and moral cowardliness (Sarkar, 1974, p.58).*

Tagore considered the lack of education to be at the root of most of the miseries of the Indian people, especially the villagers. For this reason, he attached much importance to literacy. To Tagore, if people could be made conscious of their problems, other issues would resolve automatically by themselves. To spread literacy and make the people aware of their problems, the poet not only relied on the modern methods of education and training, but also on traditional folk festivals. He patronised Bhajans (Village religious songs), Kavigans (competitive poetic spot-compositions), Jatras (open air theatres), Barashamangal (Welcome to rain) Vriksharopan (tree planting ceremony) and many other festivals (Haq, 1987, p.6). These were meant for satisfying the emotional needs of the villagers, as well as for their education for consciousness raising.

Sriniketan undertook multifarious functions, needed for village development, such as agriculture, carpentry, tanning, poultry, weaving, clay-modeling, machinery making, etc (Ibid, p.54). Tagore, however, believed that training of workers were of utmost importance if reconstruction works were to succeed. Therefore, he sent some students, including his son and son-in-law, to Europe, America, and Japan for training on various aspects of rural development (Pande, op. cit., p.89). Also, in his various endeavours in Sriniketan, Tagore got generous help from many of his

international friends. L. K. Elmhirst, a British agriculturist, was one of the most prominent among them. Tagore met Elmhirst in 1921 in the United State. Later on he joined Tagore to help him in his rural reconstruction experiments. He also accepted an offer from the poet to travel abroad with him as his secretary. Elmhirst traveled to China, Japan, Italy, and South America with the poet, which gave both of them good opportunities to study rural scene of those countries (Currie, 1964: 4).

As Elmhirst was an expert in agronomy, Tagore gave him complete freedom in conducting experiments. Tagore, however, gave a few guidelines. Two main guidelines were : (1) non-reliance on outside help; (2) an integrated or total approach, instead of piecemeal efforts (Banarjee, op.cit). Following Tagore's guidelines Elmhirst conducted many interesting experiments in rural reconstruction in a number of villages surrounding the Sriniketan. Elmhirst's experiments paved the way for later community development works undertaken by the Government of India under the auspices of the First Five Year Plan (Ibid).

In many respects Tagore's concepts of rural reconstruction were more encompassing than the approach adopted by the Indian Planning Commission. " Tagore's scheme recognised the fact that to get the best return for voluntary action it was necessary to link up with our emotional faculty" (Ibid, p.149).

There is no doubt that Tagore's accomplishments in the field of rural development experiments, were quite remarkable and the momentum generated during his lifetime also continued for quite some time after his death in 1941. Of the many achievements, notable ones include: 3 free health centres; more than 200 primary schools (as well as night schools for adult education); numerous public works; a rural bank to fight money lenders (Sarkar, 1973). Before we proceed to discuss the reasons for the gradual decline of Tagore's experiments and make an assessment of his contribution, let us compare Tagore's approach with that of Gandhi's.

Tagore and Gandhi: A Comparison of their Village Development Approaches

Both men were ardent supporters of Swaraj (home rule). But their disagreements were marked as to the means of achieving it. Tagore was vehemently opposed to Gandhi's idea of using 'Charka' (spinning wheel) as a symbol for 'Swaraj'. According to Tagore spinning wheel is too narrow a symbol to represent the self rule. In order to have home rule, people not dealing with spinning wheel should also have role to play. By this, of course, he did not belittle the importance of the spinning wheel for national development. What he meant was that real development would require all round development of all cross-sections of the society. In Tagore's words:

The path of attaining Swaraj is widespread, its methods are difficult to be implemented and it requires time too; on one side it requires aspiration and passions and on the other side, facts and reasons. In the attainment of Swaraj, the economists have to plan, the engineers have to execute, the educationists and the statesmen all have to think and work. In other words, all have to with full enthusiasm for all-round development of the country (Mukherjee, op.cit., p.232).

Voicing similar concern, the poet wrote in a letter to Srimati Rani Devi:

In a country where the majority of the inhabitants are cultivators it is absurd to put emphasis upon their duty to turn the Charka instead of urging them to perfect their proper work with the help of a better method and wider knowledge. It would include the development of scientific methods of production on cooperative principles, improved methods of seed distributions, facilities for soil analysis and the use of suitable manures (Ibid., p.234).

Tagore had been an advocate of improved cultivation techniques and also handicrafts and small industries. He also realized the importance of co-operative efforts for village development. As he was convinced that India's problems were essentially social and they needed social cooperation for satisfactory solutions. Tagore favoured a non-bureaucratic approach for the organization of the necessary force and the management of resources (Bhattacharya, 1974, p.342). The importance of the cottage industries and agriculture as one of the requirements for national prosperity was recognised by both Tagore and Gandhi (Chaudhury, 1972, p.223).

Like Tagore, Gandhi also wanted a societal solution to India's society and they glorified village life in all possible ways. Both of them advocated that the village mode of organization should be preserved and they found villages to be the true bearers of India's tradition.

Gandhi made a strong point that serious injustices have been inflicted on the villagers in India through centuries and colonialism has worsened the situation. He made a plea to the city-dwellers to return to the villagers which was their due. Gandhi was in favour of preserving the villages at any cost. In Gandhi's words:

If the village perishes, India will perish too... We have to make a choice between India of the villages that are as ancient as herself and India of the cities which are a creation of foreign domination (Shah, undated, p.125).

Gandhi had a vision of an ideal society, characterized by distributive justice, where there would be class fusion, not class conflict. This is because of his emphasis on moral and ethical issues rather than on the material component of civilization. "Whatever did not contribute to the observance of morality was not worth possessing." (Unnithan, 1979, p.180).

It is Gandhi, more than anyone else, who popularised the concept of the village community as a soultion to India's problems during the Swadeshi Samaj movement. "Gandhi had a semi-mystical vision of the village and ascribed to his ageless (and perhaps idealized) community the qualities he sought to inspire in the India of his dreams" (Braibanti, 1963, p.96).

Though in favour of preserving and promoting the village structure Tagore differed with Gandhi in terms of methodology. Tagore appears to be more pragmatic in terms of his approach to national and also village development. He was in favour of accepting and amalgamating all that is good in Indian and western cultures. As Leonard A. Gordon puts it:

> *Tagore wanted to retain the gains of western education-science, medicine, technology - and by the ground for the meeting of all cultures on a bessis of mutual exchange. He feared that Gandhism particularly in practice, would end in India's turning in upon herself and bringing about her own destruction.(Leonard, op. cit., p.185).*

Although Tagore had more progressive orientation than Gandhi, in terms of his village development ideas and experiments, his efforts failed to have a lasting impact on the society and economy of India for various reasons.

Factors Retarding Progress of Tagore's Projects

Institutions, so carefully devised by Tagore, began to falter within a short span of time. The main problems in the agriculture-related experiments arose from the weakness of the extension agencies. The agencies failed to popularise improved agricultural practices among the peasantry. Weakness in this regard also arose from the fact that in many cases basic research had not been carried out; also in many cases the impact of their results was not pretested. (Pande, op. cit., p.108).

Experiments on cottage industries did not fare any better because the training imparted was mostly of academic nature and was not of much help in practical situations. Artisans co-operatives were not formed until 1955 and there was no arrangement for the marketing of the articles produced. As a result the new artisans could not compete with the established business (Ibid., p.109).

As the co-operative credit societies were run on a very conservative basis, the poorer classes failed to reap any benefit from the credit facilities (Ibid). Also, Tagore lost the entire investment (financed by means of his Nobel Prize) in the

Rural Bank, established to fight the moneylenders, when the Bank collapsed in the 1930s (Sarkar, op. cit., p.348).

Another factor which contributed to the collapse of the Sriniketan experiments was that the institution undertook projects in so many directions and in such rapid successions that it failed to cope with all of them due to inadequate human and material resources. Still another factor which contributed to the gradual retardation of the Sriniketan projects was that people involved with various experiments were from the urban background and they did not understand the complexities of village life adequately. (Pande, op.cit., pp.109-110).

Like the later community development projects, what went fatally wrong with Tagore's experiments was the inadequate attention to the stratification of the village society. Though it can be argued that there was no want of goodwill on the part of Tagore as far as the development of villages was concerned, it was found that most of the benefits of Tagore's sincere efforts were appropriated by the powerful and richer sections in the village society. His efforts proved more to be a kind of paternalistic humanitarianism than real solutions to rural problems. Sumit Sarkar puts the point succinctly:

> *Above all, Rabindranath could not really suggest any concrete social or economic programme with which to rouse the uneducated masses. His constructive rural work amounted to little more than humanitarianism: the appeal to Zamindars was surely utopian, and the basic problems of land relations remained untouched. Thus while aware of the crucial need to bridge the gap between the Bhadralok and the masses, Rabindranath could not suggest any real solution to the problem, and his growing isolation was only to be expected. (Sarkar, op. cit., p.91).*

Conclusion: Relevance in Present Time

It is true that Tagore did very little in the form of land reforms to empower the rural poor to make them participating partners in their own affairs, but there were some strong points in Tagore's approach which cannot be ignored. Tagore's idea that problems of the rural society should be addressed at the systemic level, societal level in particular, is indicative of a deep understanding of the Indian society and culture. He envisioned that mere political independence would be of little help for the emancipation of India's countless millions of villagers. It is interesting that this view of Tagore is proving to be meaningful with the passage of time; a society-centered solution to rural problems seems to be gaining more credence in recent years. Tagore strongly felt that efforts by the state power alone would not be enough in promoting the welfare of the rural people; individual and group efforts were also necessary. In recent decades, the increasing popularity of the non-governmental organizations (NGOs) as an alternative channel to the state-

sponsored development is very much in keeping with what Tagore recommended for village development in India.

Tagore's preference for a scientific agricultural technique for raising food production, and his emphasis on modern training amply demonstrate his progressive outlook. Also, his insistence on an integrated approach to rural development, encompassing cultural and economic aspects of life, was what followed in the later community development works in India.

Tagore's argument that the villages should be the hub of development, and villagers should be able to manage their own affairs without much outside interference in substantial. He realised that development imposed from above is bound to be artificial. To put it in other words, Tagore wanted a decentralized pattern of development, with traditional local bodies playing the central role in the village affairs. Again, it is interesting to note that in recent decades most of the developing countries have been trying to adeopt some sort of decentralized strategies for the development of their rural areas, thus proving Tagore to be relevant still.

Despite their many strong points, Tagore's rural reconstruction projects gradually declined. For this Tagore, of course, has to take some blame, for not paying adequate attention to some structural issues - social stratification and land reforms, in particular, as we have seen above. However, to pass all the blames on Tagore is probably unfair. By the time his rural reconstruction works were undertaken, there were not enough lessons before Tagore so that he could take precautionary measures. Tagore's rural reconstruction effort was one of the first in the Indian setting. Even it took development theorists and practitioners quite some time to realize that if intended benefits of community development projects were to reach the rural poor, special safeguards in their (poor) favour were necessary. The focus of the programmes should be directed to the disadvantaged and vulnerable groups like the landless, women, and marginal farmers. Tagore would have probably realized this fact had he lived long enough to see for himself some of the impacts of his own programmes on the society.

In conclusion, despite many shortcomings, Tagore should be credited with showing a pragmatic way to village development in India. In many respects, he wanted to come out of the high emotionalism of the nationalist Swadeshi movement, of course, not denying its constructive components. His concern for an integrated approach to rural development through scientific agricultural techniques will be considered as major contributions to the cause of the advancement of village societies in India; and societies with similar socio-economic circumstances have also much to learn from Tagore's ideas and experiments. In this paper we have focused only on some of the selected themes of Tagore's ideas and approaches to rural development which are still relevant and could be fruitfully pursued by the state as well as by the other concerned actors in rural development in countries with large rural sectors.

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Fertilizer Recommendation for the Cropping Pattern Boro-Transplanted Aman Rice in Jessore

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Abstract

An attempt has been made to estimate the residual effect of phosphorus and potassium in Farming System Research Site of High Ganges flood plain soil of Jessore from fertilizer application to Boro (Winter) season of 1990-91, five treatments were tested namely (1) Recommended dose (recommended doses of N, P_2O_5, K_2O, S & Zn) (2) Recommended dose phosphorus (3) Recommended dose minus potassium (4) Recommended dose minus phosphorus and potassium and (5) Farmers' practice. In kharif II season of 1991 and following Boro season of 1991-92 three levels of phosphorus (0,30, 60 kg P_2O_5 P_2O_5 ha^{-1} from SSP) in combination with three levels of potassium (0,20, 40 kg K_2O ha^{-1} from MP) were used in addition farmers' practice also. In first Boro (winter) season, results showed that Recommended dose significantly increased the grain yield but lack of phosphorus and potassium individually or in both failed to produce any significant effect. In kharif II 1991 and Boro (winter) 1991-92 seasons, economically sound yield obtained from treatments T_7 ($P_{30}K_{40}$) and T_4 ($P_{60}K_{20}$) respectively. Farmer practice failed to produce any significant effect in first two seasons but significant effect was found in last season only.

Introduction

A fertilizer recommendation aims at stating precisely the amount of fertilizer to apply to a soil in order to ensure the mineral nutrition of a crop with a view to obtaining the optimum yield that means a level of yield which judges to the adequately economic (Chavarria, 1982, pp.93-100).

The quantity of phosphorus and potassium needed depends on the kind of plant and the desired yield. One ton of wheat takes up 20 kg P_2O_5 and one ton of rice takes up 25% of that (Dabin, 1980, pp 217-232). Crop composition at harvest can provide a basis for estimating annual fertilizer needs, but tests with tracers have shown that about 20% of phosphorus fertilizer is used by the plant and about 80% that about 20% of phosphorus fertilizer is used by the plant and about 80% remains

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in the soil. Forms of fertilizers have variable levels of solubility and different reaction with the soil. Phosphate soluble in water is assumed to leave the most valuable residues, 2/3 rds are left after one crop, 1/3 rd after two crops and 1/6 after three crops. All phosphates are assumed to be exhausted after four crops have been taken (Richard's, 1975, pp.12-15).

Boro-T. aman is the major cropping pattern in the irrigated medium high land of Jessore district. It covers 33% of the total area. There is no fertilizer recommendation for the pattern as a whole. Rather there is a recommendation on the individual crop basis. But P and K have residual effect due to their fixation and if can be quantified the availability and uptake then it will be easier to recommend the fertilizer dose considering residual effect. With the above fact in mind the trial was undertaken.

Materials and Method

Three consecutive experiments were carried out at FSR site, Bagherpara, Jessore during Boro 1990-91 to Boro 1991-92. Trials were laid out in a Randomized Complete Back Design (RCBD) with 4 dispersed replications. 'Ratna' and 'BR 11' were used as test varieties in Boro and Aman seasons respectively. Five treatments were tested in Boro season 1990-91, namely (1) Recommended dose (recommended doses of N, P_2O_5, K_2O, S and Zn). (2) Recommended dose minus phosphorus. (3) Recommended dose minus potassium. (4) Recommended dose minus phosphorus and potassium and (5) Farmers' practice. In Kharif II season of 1991 and following Boro season of 1991-92, three levels of phosphorus (0,30,60 kg P_2O_5 ha^{-1} from TSP) in combination with three levels of potassium (0,20 & 40 kg K_2O ha^{-1} from MP) were used. Nitrogen sulfur and zinc were applied at the rate of 100 kg N^{-1} ha 20 kg S^{-1} ha and 4 kg Zn/ha $^{-1}$ respectively from Urea, Gypsum and Zinc Sulphate. A total of nine treatment combinations and a farmer's practice were included in this experiment. Thirty to thirty five days old seedlings were transplanted during January 91-92, and July 91 for Boro and Aman crops maintaining 20 x 15 cm spacing with 3-4 seedlings per hill. As per design of the treatments, whole amount of P^2O^5, K_2O, S and Zn were added to the soil at final land preparation. Nitrogen was top dressed into three equal splits at 10, 25 and 40 days after transplanting. In farmers plot where they apply fertilizers according to their own choice were 120, 40, 31 and 19 kg N, P_2O_5, K_2O and S ha^{-1} respectively called farmer's practice. Cultural operations e.g. irrigation, weeding and insecticide applications were done uniformly according to need. Ratna and BR-11 were harvested at the age of 110-120 and 140-150 days respectively. Grain yield and yield component data were collected and analysed statistically as per Gomez and Gomez (1984).

Results and Discussions:

Properties of the Initial Soil Samples

Some properties of the initial soil samples from the experimental sites are presented in table-1. The texture of the site area is caly loam Soil p^H is 7.2 slightly alkaline. Organic matter content and available nitrogen are very low. The initial phosphate level clearly falls below the theoretical optimum requirement of rice. hence, a response to phosphate may be expected. Exchangeable K is above critical level so judicious application should be followed.

Effect of P and K on Yield

Effect of P and K fertilizers on the yield and yield components of Ratna, BR 11, Ratna pattern at FSR site, Bagherpara, Jessore are presented in table 2.3 & 4 respectively.

Analytical data showed that soil was deficient in P but less deficient in K and yield data was the reflection of the same. If yield data is verified from table-2, it was clearly understood that lack of P and K reduced the yield significantly in 1990-91 means, soil was deficient in P or K or both. But the rate of reduction was more when P was absent than K. This result is indirectly supported by the results of (Abedin and Eaqub in 1980, pp. 59-65) It appeared from the result that the soil under study was truely less deficient in K than P.

From table-3, it might be evident that all parameters of yield including straw yield failed to produce any significant effect except grain yield and effective tillers/ m2. Effective tillers/m^2 showed significant effect only from farmers' practice other-wise among the treatments there were no significant effect. The same was ture for grain yield. Different rates of P and K and sometimes lack of either P or K failed to produce any significant effect among the treatment combinations (Table-3) meaning that residual effect of P and K minimized the yield reduction. Irrespective of significance if we compare the treatments it of both P and K yielded lower than individual absent of P or K.

In a column, mean followed by the same letter (s) do not differ significantly by DMRT at alpha 5%.

Like table-3, table-4 showed the similar trend of P and K effect on yield and yield parameters except straw yield. Straw yield produced significant effect in 1991-92 but failed in 1991. In first and second season farmer's practice failed to produce any significant effect on grain yield but in third season produced significant effect.

Plant can make satisfactory growth with very small concentration of dissolved P, if that concentration is maintained. The rate of replenishment and mineralization reactions making additional P available seem generally to be fast enough to meet

plant needs (Olsen and Watanabe, 1966, pp.598-602). Two of such concentrations in the study were P_{30} K_0 which produced significant yield and highest MBCR in 1991 and P_{60} K_{20} in 1991-92.

Available N, P and K Status of the Soil

The data in table-5 show that continuos application of different amounts of fertilizer P led to an increase in the level of available P to medium or high levels after two cycles of crops. The initially low level of a available N and high level of K did not change substantially with any of the rates of fertilizer N or K application (Viswas et. al., 1977, pp.414-421).

Initially the phosphorus actually present in soil solution can be taken up by the plant, but as this is removed, it is replenished by more phosphorus coming into solution from the labile pool of phosphorus. The rate of releasc of the non labile phosphorus is very slow. If crops were grown continuously on a soil without adding any phosphate fertilizer, more and more of the soil phosphate would become available, but the rate of dissolution would fall and soon be below the optimum needed for a crop. As a result, yields would drop and would only be restored by the use of P fertilizer. Fertilizer phosphorus will generally be more available to crops than soil phosphorus.

Exchangeable K, often do not correlate well with crop response in field experiment notably when soils differ in clay content and clay composition (Grimme, 1975, pp.131-136). This is not surprising plant roots take up nutrients from the soil solution. As the K concentration in the solution increases, more K ions can reach the plant roots with in a given time and the amount of K ions that can be taken up by the plant increases (Grimme et. al., 1971).

Uptake of Iimportant Nutrients

An adequate and balanced supply of plant nutrients is a pre-requisite to maximise crop production. Rice is no exception. The average chemical composition of grain and straw against different treatments is given in table-6. The total uptake of the nutrients by the rice crop was calculated from these analyses and from the average yields of grain and straw. The data from table-7 show that the crop with an average grain and straw yield of 11.1 t/ha from treatment T1 removed about 87, 15 and 95 kg N, P_2O_5 and K_2O ha^{-1} respectively. It is seen that very large quantities of nitrogen and potassium are required for the rice crop whereas the P_2O_5 requirement is comparatively very low.

If we go through the treatments from table-7 we may notice that treatments T_3, T_8 and T_9 stored 20.1, 18.0 and 17.9 kg P_2O_5 ha^{-1} as soil residues which are obviously below critical level. On the other hand, T1 T4 and T5 treatments phosphate residues are in sufficiently level (102.5, 105.5 and 110.7 kg P_2O_5 / ha respectively).

In treatments T2, T6, T7 and T10 phosphate residues (67.3, 70.2, 67.6 and 75.6 kg P_2O_5 / ha) are in critical level and sufficient to produce optimum effect. Since p^H of these soil is 7.2, phosphate fixation may be minimum.

Phosphate fertilizer may not bring good response except on soils having very low availability of P_2O_5. The soils on which these experiments were conducted had a low level of available P_2O_5 viz., 18 ppm. The application of 60 kg P_2O_5 /ha is sufficient for the first season and in the second season of 37 ppm phosphate residues, 30 kg P205 / ha application is enough to give good response when it is taken in to account that only about 13 kg of this nutrient was required for the production of a good crop of rice yielding 5.09 t/ha. Nitrogen residues in all treatments fall below critical level, but potash residues all above optimum level even though where potash was not applied.

Conclusion

If a soil is fertilized @ 80-60-40 kg of N, P_2O_5, K_2O ha^{-1} in first season of a low phosphate and above critical level of K soil, no need to apply K in second season but apply 30 kg P_2O_5 and in third season again apply 60 kg P_2O_5 and 20 kg k_2O with sufficient amount of nitrogen if soil is loam to clay loams and rainfall is less. The same is quite true after soil, plant and economic analysis.

The amount of fertilizer application should be based on (i) nutrient status of the soil (ii) its removal by the crop and (iii) profitability of its application. Generally, N.P.K. are recommended for HYV rice in the ratio of 4:3:3 but for deficient soils higher dose need to be recommended. Therefore, soil, crop analyses and response should be the guide line in recommending fertilizer.

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Table-1: Physical and Chemical Properties of Soil at FSR Site, Jessore

Physical Properties		Chemical Properties		Nutrient		Status (Kg/ ha)	
Sand (%)	29.44	pH	7.20	-		-	
Silt (%)	31.40	Organic matter (%)	0.99	-		-	
Clay (%)	39.16	Available N (ppm)	34.00	N	68	N	68.0
Textural Class	Clay loam	Available P (ppm)	4.00	p	8	P_2O_5	18.4
		Exchangeable K (me/100 g soil)	4.00	K	312	K_2O	374.4

Table-2: Effect of Phosphate and Potash on Yield and Yield Component of Variety Ratna at FSR Site, Bagherpara, Jessore, 1990-91

Treatment	Plant ht. (cm)	Effective Tillers per m^2	Grains/ Panicle	1000- Grain wt. (g)	Grain Yield (t/ha.)	Straw Yield (t/ha)
T_1 =Recommended dose	85.50	506	79	21.68	8.47a	8.92
T_2= Recommended dose minus P	84.40	481	72	21.08	7.06b	7.80
T_3= Recommended dose minus K	85.00	495	76	21.56	7.46b	7.82
T_4= Recommended dose minus P&K	83.30	457	69	21.04	6.92b	7.25
T_5= Farmers' practice	85.50	402	78	21.61	6.50c	8.88
CV (%)	-	-	-	-	6.38	-

Note: For each P_2O_5 = P and K_2O = K

Table-3: Effect of Phosphate and Potash on Yield and Yield Component of 'BR 11' at FSR Site, Bagherpara, Jessore, 1991

Treatment P_2O_5 K_2O kg/ha	Plant ht (cm)	Effective Tillers / m^2	Grains / Panicle	1000- Grain wt. (g)	Grain Yield (t/ha.)	Straw Yield (t/ha)	Gross Return (Tk.)	MBCR (Tk)
$T_1 = P_{60} K_{40}$	115.65	349a	98	24.36	5.53a	5.57	33871	4.24
$T_2 = P_{30} K_{40}$	114.93	342a	98	24.13	5.11ab	5.14	31299	3.26
$T_3 = P_0 K_{40}$	117.78	328a	86	24.10	4.93ab	5.38	30196	4.00
$T_4 = P_{60} K_{20}$	113.50	340a	92	24.35	5.24ab	5.38	32095	3.27
$T_5 = P_{60} K_0$	117.23	343a	92	24.29	5.48ab	5.52	33565	5.72
$T_6 = P_{30} K_{20}$	116.05	333a	89	24.09	5.01ab	5.27	30686	3.23
$T_7 = P_{30} K_0$	117.03	335a	90	24.25	5.09ab	5.43	31176	5.79
$T_8 = P_0 K_0$	117.20	326a	94	24.06	4.80ab	5.38	29400	3.67
$T9 = P_0 K$	117.88	309a	78	24.04	4.69bc	5.39	28726	-
T_{10} = Farmer's practice	109.55	267b	75	24.07	4.11c	4.99	25174	-
CV (%)	5.42	8.13	14.78	2.69	9.65	11.58	-	-
Level of significance	NS	*	NS	NS	*	NS	-	-

In a column means followed by the same letter(s) do not differ significantly by DMRT at alpha = 5%

Price of rice = Tk. 6125/ton
Price of P_2O_5 = Tk. 14.10/kg
Price of K_2O = Tk. 9.18/kg
MBRC = Marginal Benefit Cost Ratio

Table-4: Effect of Phosphate and Potash on Yield and Yield Component of 'Ratna' FSR Site, Bagherpara,Jessore, 1991-92

Treatment (P_2O_5 K_2O kg/ha)	Plant ht. (cm)	Effective Tillers / m²	Grains / Panicle	1000- Grain wt. (g)	Grain Yield (t/ha.)	Straw Yield (t/ha)	Gross Yeturn (tk.)	MBCR (Tk)
$T_1 = P_{60}\ K_{40}$	87.75	442ab	68	21.82	6.37a	6.94a	39016	10.80
$T_2 = P_{30}K_{40}$	85.73	450a	64	21.59	5.76abc	6.29abc	35280	11.85
$T_3 = P_0K_{40}$	85.25	410abcd	63	21.22	4.88dc	5.36cf	29890	10.84
$T_4 = P_{60}\ K_{20}$	87.25	438ab	66	21.94	6.26ab	6.54ab	38343	12.08
$T_5 = P_{60}\ K_0$	85.50	426abc	64	21.72	5.66bc	5.94bcde	34667	10.35
$T_6 = P_{30}\ K_{20}$	85.50	411abcd	64	21.73	5.33cd	5.67cdef	32646	11.11
$T_7 = P_{30}\ K_0$	85.00	408bcd	61	21.60	5.01de	5.51def	30686	11.29
$T_8 = P_0\ K_0$	84.75	388 cd	60	20.91	4.50ef	5.07 f	27562	9.00
$T9 = P_0\ K_0$	84.25	378 d	59	20.72	4.23 f	5.14f	25909	1.00
T_{10} = Farmers practice	86.23	440 ab	64	21.44	5.73abc	6.10abcd	35096	10.83
CV (%)	2.18	5.78	10.99	3.19	7.86	7.20	-	-
Level of significance	NS	**	NS	NS	**	**	-	-

In a column means followed by the same letter (s) do not differ significantly by DMRT at alpha = 5%.

Price of rice = Tk. 6125/ ton
Price of P_2O_5 = Tk. 14.10 / kg
Price of K_2O = Tk. 9.18/ kg

Table-5: Available N, P_2O_5, K_2O Status of Soil Before and After Cropping at FSR Site, Jesssore.

Treatment (P_2O_5, K_2O kg/ha)	Available Nutrients from Soil						Available from Fertilizer		
	N kg/ha		P_2O_5 kg/ha		K_2O kg/ha		N kg/ha	P_2O_5 kg/ha	K_2O kg/ha
	Before	After	Before	After	Before	After	Application	Application	Application
T1= Recommended dose	68	72	18.4	36.8	374.4	421.2	80	60	40
T2=Recommended dose-P	68	64	18.4	13.8	374.4	393.1	80	0	40
T3=Recommended dose-K	68	67	18.4	32.2	374.4	337.0	80	60	0
T4 = Recommended dose-P,.K	68	62	18.4	23.0	374.4	327.6	80	0	0
T5= Farmer's Practice	68	73	18.4	25.3	374.4	383.8	120	40	30
$T_1 = P_{60} K_{40}$	72	75	36.8	57.5	421.2	430.7	100	60	40
$T_2 = P_{30} K_{40}$	72	75	36.8	50.6	421.2	416.5	100	30	40
$T_3 = P_0 K_{40}$	72	68	36.8	32.2	421.2	416.5	100	0	40
$T_4 = P_{60} K_{20}$	72	73	36.8	59.80	421.2	413.7	100	60	20
$T_5 = P_{60} K_0$	72	72	36.8	64.4	421.2	411.8	100	60	0
$T_6 = P_{30} K_{20}$	72	70	36.8	52.9	421.2	414.6	100	30	20
$T_7 = P_{30} K_0$	72	70	36.8	50.61	421.2	411.8	100	30	0
$T_8 = P_0 K_0$	72	69	36.8	30.2	421.2	413.7	100	0	20
$T9 = P_0 K_0$	72	66	36.8	27.6	421.2	411.8	100	0	0
T_{10} = Farmer's practice	73	74	25.3	46.0	383.8	347.4	120	40	31

Table-6: Effect of Fertilizer and Nutrient Uptake of N, P_2O_5 and K_20 after Twocycles of Crop by the Rice Variety BR 11

Treatment P_20_5 / K_20 kg/ha	N kg/ha			P_2O_5 kg/ha			K_20 kg/ha		
	Grain	Sraw	Total	Grain	Straw	Total	Grain	Straw	Yield
$T_1 = P_{60}\ K_{40}$	58.62 (1.06)	28.41 (0.51)	87.03	11.06 (0.20)	3.90 (0.07)	14.96	16.59 (0.30)	77.89 (1.40)	94.57
$T_2 = P_{30}K_{40}$	54.68 (1,07)	26.73 (0.52)	81.41	9.71 (0.19)	3.60 (0.07)	13.31	15.33 (0.30)	71.96 (1.40)	87.29
$T_3 = P_0K_{40}$	52.26 (1.06)	28.51 (0.53)	80.77	8.87 (0.18)	3.23 (0.06)	12.10	14.79 (0.30)	75.32 (1.40)	90.11
$T_4 = P_{60}\ K_{20}$	55.54 (1.06)	27.44 (0.51)	82.89	10.84 (0.20)	3.77 (0.07)	4.25	15.72 (0.30)	75.32 (1.40)	91.04
$T_5 = P_{60}K_0$	57.54 (1.05)	27.60 (0.50)	85.14	10.41 (0.19)	3.31 (0.06)	13.72	15.34 (0.28)	75.07 (1.36)	90.41
$T_6 = P_{30}\ K_{20}$	53.60 (1.07)	27.40 (0.52)	81.00	9.52 (0.19)	3.16 (0.06)	12.68	14.53 (0.29)	72.73 (1.38)	87.26
$T_7 = P_{30}\ K_0$	53.45 (1.50)	27.15 (0.50)	80.60	9.67 (0.19)	3.26 (0.06)	12.93	14.25 (0.28)	73.85 (1.36)	88.10
$T_8 = P_0\ K_0$	50.40 (1.05)	27.44 (0.51)	77.84	8.16 (o.17)	3.23 (0.06)	11.39	13.92 (0.29)	74.24 (1.38)	88.16
$T9 = P_0\ K_0$	49.25 (1.05)	26.95 (0.50)	76.20	7.04 (0.50)	2.70 (0.05)	9.74	13.13 (0.28)	73.30 (1.36)	86.43
T_{10} = Farmer's practice	44.39 (1.08)	26.44 (0.53)	70.83	7.40 (0.18)	2.99 (0.06)	10.39	11.92 (0.29)	68.86 (1.38)	80.78

N.B. Numerical values in parenthesis express in percent

Table- 7: Nutrient Availability, Nutrient Uptake and Soil Residues

Treatment (P_2O_5 kg/ha) (K_2O kg / ha)	Avaiable Nutrient from Soil and Fertilizer(Kg/ha)			Crop Removal (kg/ha)			Soil Residues (Kg/ha)		
	N	P_2O_5	K_2O	N	P_2O_5	K_2O	N	P_2O_5	K_2O
$T_1 = P_{60} K_{40}$	175.0	117.05	470.7	87.0	15.0	94.6	88.0	102.5	376.1
$T_2 = P_{30} K_{40}$	175.0	80.06	456.5	81.4	13.3	87.3	93.6	67.3	369.2
$T_3 = P_0 K_{40}$	168.0	32.02	456.6	80.8	12.1	90.1	87.2	20.1	366.4
$T_4 = P_{60} K_{20}$	173.0	119.08	433.7	83.0	14.3	91.0	90.0	105.5	342.7
$T_5 = P_{60} K_0$	172.0	124.04	411.8	85.1	13.7	90.4	68.9	110.7	321.4
$T_6 = P_{30} K_{20}$	170.0	82.69	434.6	81.0	12.7	87.3	89.0	70.2	347.3
$T_7 = P_{30} K_0$	170.0	80.06	411.8	80.6	13.0	88.1	88.1	89.4	323.7
$T_8 = P_0 K_0$	169.0	30.02	433.7	77.8	11.4	88.2	91.2	18.8	345.5
$T9 = P_0 K_0$	166.0	27.06	411.8	76.2	9.7	68.4	89.8	17.9	325.4
T_{10} = Farmer's practice	174.0	68.00	405.4	405.4	70.8	80.8	103.2	75.6	324.6

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Environment Oriented Resources Planning in Intensive Agriculture: Issues and Strategies in Bangladesh

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Abstract

It is becoming increasingly clear that a more sustainable agriculture can bring economic, environmental and social benefits to farmers, communities and nations. This article draws together a diverse range of agro-ecological and community settings for environment oriented resource planning to sustainable agriculture in Bangladesh.

The first three chapters outline the existing farming practice, physical setting, natural and agro-ecological environment, agriculture policy and land use in Bangladesh. The next four chapters analyse the key environmental issues, environmental policy relating to agriculture, fisheries and live-stock, forestry, wildlife and water resources of Bangladesh. The last chapter details the issues, strategies and action plan to greater sustainability and resource planning in agriculture.

Introduction:

Bangladesh is one of the largest populous country in the world, with 755 people living per square kilometer (GOB, 1990). The annual population growth rate of the country is 2.01 percent (BBS, 1991). Agriculture dominates the economy and life of Bangladesh contributing 40% to the GDP and is the most important component of land use. Traditionally rice is the staple food and more than 80% of cultivable land is under paddy cultivation. In an attempt to gow more rice, all the infrastructure has been developed for increased production of rice with less emphasis on production of other food items like pulses, oilseeds, fruits and vegetables. The major cash crops are jute, tea and sugarcane. Attempts to increase all agricultural production from limited land resources is too difficult despite using improved technology, HYV seed, flood control and increased use of fertilizers and pesticides associated as all these are being with conservation and environmental degradation.

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Farming Practice

Farming is predominantly a small land holding activity with more than 50% of the farmers cultivating less than 1.1 hectare and such holding covers 32% of the cultivable land. It is observed that small farmers are more efficient. The number of landless and marginal farmers constitute more than 50% of the population. Food grain production having a marked preference over non-cereal crops, has incresed from 9 million tons in 1960 to over 18.75 million tons in 1989-90. Attempt at crop diversification has not been popular due to unfavorable value differential of crops per hectare in comparison with Boro Paddy, the main competitor for land. The increased demand for food and fodder has already started disruption of natural resource base in Bangladesh. Some of the critical areas are

- reduction of forest cover;
- soil erosion;
- salinity;
- depletion of aquifers for irrigation;
- desertification; and
- loss of traditional genetic resources of flora and fauna

These problems are affecting:

- Protection of habitats;
- Threaten the basis of agricultural production;
- Imperil the prospects of developing improved verieties of Crops, Livestock,Fisheries and Forestry.

The challenge therefore is to formulate an Environment oriented Resource Planning in Intensive Agriculture.

This paper will attempt to identify the key environmental problems of this sector. Thrust is given to issues related to sustainable agricultural resource planning and food production, use of agro-chemical and safety of agricultural workers. Finally an outline action plan and an implementation strategy has been proposed to address these issues.

The Physical Setting

Bangladesh is situated between latitude 20.25^0 to 26.38^0 N and longitude 88.1^0 to 92.40^0 E and constitutes the delta of three mighty rivers the Ganges, the Brahmaputra and the Meghna. The drainage system is ill defined and very poor in many places. The rivers, both big and small are incapable of draining the huge

quantity of silt laden run-off passing through these during the monsoon season. At least 20% area of the country is normally inundated every year and causes both direct and indirect damages. The country is extremely flat with ground slopes extending from the north to the south ranging from 80 meters above Mean Sea Level (MSL) at the boundary at Tetulia to around 3m at the coastal area in the south.

- Several large depressions have been formed during the process of delta building, particularly in the Mymensingh and Sylhet districts;
- There is a complex of internal draining depressions (haors), meandering flood channel and abandoned river courses which are widely flooded every monsoon season.

Water levels of the rivers begin to rise steadily at the onset of the monsoon and reach their peak level in July, August or September and the inundated area normally may cover an area of about 26,000 sq. km.

Table-1: Land Types Defined on the Basis of Flood Depth

Land Type	Description	Area in m/ha (%)	Flood Depth	Name of Flooding	Remarks
FO	High Land	3.27(36)	0.30 cm	Intermittent	Land suited to HYV rice
FI	Medium High Land	3.15(35)	30.90 cm	Seasonal	Land suited to Local Varieties of Aus & T. Aman.
F2	Medium land	1.43(16)	90.18 cm	Seasonal	Land suited to B. Aman
F3	Low Land	1.10(12)	Greater than 90.18 cm	Seasonal	Land on which B. Aman can be grown
F4	Low to very low land	0.08(I)	Greater than 180 cm	Sealsonal to Perennial	Land on which either the depth or timing of flooding do not permit to grow B. Aman.

Natural Environment

Bangladesh occupies an area of 1,44,863 sq. km. comprising approximately 14.40 million hectares. Major land uses are shown in Table- 2.

Table-2 Major Land Uses in Bangladesh

Land use	Area(million ha.)
Agriculture	9.25
Forest under Forest Department	1.49
Unclassified State Forest	0.73
Village woodlot including fruit trees	0.27
Housing Settlement	1.16
Water bodies (dry season status)	0.94
Others	0.36
Total land area	14.40

Physiographic Regions

There are 3 broad physiographic regions:

Regions	**Percentage of land area**
Flood plains	about 80%
Terraces	about 8%
Hills	about 12%

Agro-Ecological Environment:

There are 30 broad agro-ecological regions in Bangladesh, with 88 sub-regions. In addition to the regional diversity in agro-ecological conditions, there are considerable local variations with respect to soil type, soil moisture regime and properties. Thus production factors in Bangladesh agriculture are diverse and complex. Therefore, the increasing demand for food can only be met and sustained by a judicious and scientific management of the natural resources.

Agricultural Policy for Food Autarky

The objective of the Government is to increase production of food grains to attain self-sufficiency. The increase in food production is being carried out through intensive cropping pattern by:

- increased use of ground water;
- increased surface water irrigation;
- intensive use of agro-chemicals;
- introduction of improved crop varieties (HYV);
- improving the supplies of better agricultural inputs; and
- improvement in the efficiency and out reach capabilities of the extension services.

Major Constraints to Agricultural Productivity

- frequent natural disaster;
- shortage of land;
- high population densities;
- unstable markets;
- lack of appropriate sustainable technology;
- inadequate investments (due to defective tenurial arrangement);
- insufficient extension supports interims of outreach capabilities;
- lack of proper public awareness to increase food production;
- rice monoculture and lack of conservation of genetic resources;
- sand deposition and desertification;
- desertification, wildlife extinction and loss of natural habitat;
- loss of bio-diversity;
- riverbank erosion and population replacement; and
- lack of environmental legislative measures enforceability and management efficiency.

Land Use in Bangladesh:

Land resource in Bangladesh is very limited and fixed. Almost all sectors compete for the use of land and competition is intense due to high man-land ratio. Environmental issues relating most directly to this sector resource are;

(1) Continual erosion of land by rivers.

(2) Increasing landless and fragmentation.

(3) Unclear status and pattern of land ownership.

(4) Lack of land use planning.

These issues contribute to the land wastage and soil degradation.

Key Environmental Issues:

The greater thrust on food grain production, principally through increased agricultural intensification and increase in irrigated area, has contributed to the development of a number of environmental problems which are varying in degrees in different regions of the country. The most pressing environmental issues are:

(1) Loss of bio-diversity through the conversion of land to agriculture;

(2) Abandonment of many indigenous crop varieties in favour of HYV's which will lead to irreversible loss of country's genetic resources. This may have considerable consequences when global climate changes become manifest in Bangladesh;

(3) Depletion of soil fertility due to intensive cropping. Principally a reduction in soil nutrients and organic matter;

(4) Loss of wetland habitats through abstraction, drainage and in filling which results in depletion of aquatic fauna and flora and reduction in water availability to the rural poor;

(5) Loss of forest resources due to permanent agricultural encroachment and shifting subsistence cultivation in the Hill Tracts, which reduce aquifer recharge and lead to increased soil erosion;

(6) Desertification (e.g. Barind Tract) which has resulted from deforestation for agricultural development;

(7) Increased use of agro-chemicals which raises the possibility of pollution of surface and ground waters, accidental poisoning and eutrophication of surface water bodies;

(8) Increased emphasis on rice mono culture and decreased cultivation of other crops can lead to malnutrition amongst farm families;

(9) Fodder shortage due to increased cultivation of rice and other crops production;

(10) Reduction in river flows due to surface water abstraction which adversely affects fisheries, downstream water users, navigation and ecology.

Environmental Policy Relating to Agriculture

The Government of Bangladesh has adopted an environmental policy which makes following statements concerning agriculture:

- Ensure all steps taken and technologies adopted for agricultural development and attainment of self sufficiency in food are environmentally sound;

- Sustain the basis of all agricultural resources in the process of development and ensure their long term use is environmentally sound;

- Regulate the use of those agro-chemicals, artificial materials and inputs which diminish the natural fertility and organic properties of the soil and cause adverse impacts on man and animals. Ensure safety of agricultural workers who apply such inputs. Encourage the application of various natural fertilizers and insecticides;
- Facilitate environmentally sound development in agriculture sector through appropriate change in production management;
- Increase the use of environment friendly natural fibres like Jute and Jute products.

Fisheries and Livestock:

Fisheries contribute about 6% to the GDP and 80% of animal protein intake and more than 12% to the export earnings of the foreign exchange earnings of Bangladesh economy. Similarly livestock is one of the major source of animal protein and important source of cash income. This sub-sector contributes 6.5% to the GDP and 13% to the total foreign exchange earnings of the country. The policy aims to increase livestock and fish production by improving resource bases and improving technology

Forestry, Wildlife and Bio-diversity:

Forestry as one of the principal renewable resources has a vital role in sustenance of the poor. It contributes 3% to GDP and about 2% of the total labour force is employed in this sub-sector with continued depletion of tree resources and consequent environmental degradation. The Government of Bangladesh has adopted the following environmental policy relating to forestry, wildlife and bio-diversity:

- Conserve, development augment forest with a view to sustain ecological balance and meet socio economic needs and prevailing realities;
- Conserve wildlife and bio-diversity;
- Conserve and develop wetland and protect migratory birds;
- Call for education to play a significant role in achieving the policy objectives.

Water Resources in Bangladesh:

There is a unique dimension of water resources in Bangladesh. But it's erratic distribution both in temporal and spatial occurrence has posed to be a major

impediment to water development for maximizing contribution to the national economy. To achieve 3.6% growth in agriculture sector, it has been planned to bring 4.8 million hectares of land under irrigation by 1994-95, which is 55% higher than achieved in 1989-90. Out of this area 37% will be brought under surface irrigation and 63% under ground water irrigation. In respect of flood control and drainage, a total of 3.64 million hectare will be brought under this program by 1994-95, with an increase of 12% over the base year 1989-90. In the past planning and construction of embankments were done without due consideration towards agriculture, fishery, land use, environment and other socio-economic aspects. Currently these aspects are duly taken into consideration by involving all concerned agencies and initiating appropriate studies.

Strategies and Action Plan:

Agriculture dominates the economy and life of Bangladesh contributing 39.39% to the GDP and is the most important component in the land use. It has profound effects on the natural environment principally in the fisheries, livestock, forestry and environment sectors through transport, energy and other sectors are greatly influenced by it. Strategies and actions to address environmental issues from agricultural activities will require a constant efforts of concerned sectoral ministries, NGO's and other agencies.

Directorate of Agricultural Extension (DAE)

The Department of Agricultural Extension is the executing agency within the MOA can provide knowledge support to the farming community. Currently it's block supervisors in each Thana who interface with the farming community. The block supervisors are involved in the collection of agricultural data on cropping patterns, yields and use of agro-chemicals amongst other things. DAE's extension worker can extend agricultural support services by improving training and out reach capabilities of the field staff.

Institutional strengthening actions can be suggested which needs to be implemented in the agricultural sector as a matter of urgency.

- ***DAE Environmental Cell***
  - Establishment of an environmental cell within the DAE which would be responsible for formulation and dissemination of appropriate recommendation for environmentally sound agricultural practices via the extension service, such as eco-farming, appropriate agro-chemical use, soil and water conservation, environmental impact awareness.

Agriculture and Environment Unit in DAE

- Development of an Agriculture and Environment Unit (AEU) within DAE should be responsible for conducting and reviewing environmental assessment of agricultural development projects.

Desertification Control

Scarcity of water for cultivating and domestic purposes during winter is the main problem in large areas of the Barind Tract. In Madhupur Tract the main problems are loss of much of the natural vegetation and the top soil. Appropriate conservation and agro-forestry practices should be adopted in those two areas to prevent land and environmental degradation as well as sustained agricultural production. Water conservation through water shed management and water harvesting. Dry land farming practices can be adopted and horticultural development can be emphasised.

Promotion of Environmentally Sustainable Farming Methods

- This can be achieved through control of shifting subsistence agriculture in sensitive areas and the encouragement of more sedentary farming methods in the Chittagong Hill Tracts.

Agro-Chemical Impact Study

- Study on the impacts of high and low quantum of agro-chemical uses;
- Environmental impacts related to pollution, health and fisheries / livestock.

Environmental Assessment

- Environmental Assessment of all major agricultural development projects and those which will affect natural habitat;
  Assessment of major changes in cropping patterns and DAE extension messages;
- Comparison of cost-benefit of agricultural development in relation to existing land productivity and employment opportunities such as fisheries, forestry etc.

Indigenous Crop Inventory

- Inventory, Collection and Preservation of indigenous varieties of all crops.

Degraded Land Rehabilitation Programme

- To control land degradation appropriate farming and agro-forestry systems should be introduced. Key targetted areas are Hill Tracts, Barind Traets and Madhupur Tracts.

Coastal Zone Agricultural Guidelines and Coastal Area Development plan

- Guide lines on agricultural development and crop diversification should be prepared for major coastal agro-ecological zones;
- An integrated planning approach towards land use and development of agriculture, forests, fisheries and livestock could be adopted.

Sustainable Farming Systems Extension

- Introducing and encouraging multiple cropping, inter cropping, green manuring, mulching, crop rotation which are appropriate for different agro-ecological zones of the country;
- Easy credit facilities for farmers.

Promotion of Traditional Crops

- Local / traditional crop verities should be promoted where these are best suited to agro-ecological and flooding conditions.

Integrated Pest Management

- Increased research and Promotion of integrated pest management;
- Establishment of additional demonstration research plots in all agro-ecological zones of the country.

Role of NGO's

- Involvement of NGO's should be encouraged to complement extension & supply functions of various Government agencies at village, union and thana levels.

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Technological Change and Rural Women in Bangladesh

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Abstract

Gender bias of agro-based technology has emerged as an important development issue for discussion. Scholars identified both negative and positive effects of the technological innovations on the income and employment of rural women. This article attempts to critically analyses the women's position in rural household economy of Bangladesh. Section 1 briefly introduces the topic. Section 2 discusses the traditional sexual division of labour and its emerging trend. Section 3 focuses attention on the forms of technological change occurred in the rural society and their impact on the rural women. The final section provides few concluding remarks and suggestions for improvement of the present conditions of the rural women of Bangladesh.

Introduction

Since early 1960s, most of the developing countries of the world have been pursuing massive programmes for technological change in agriculture in the form of 'green revolution.' The green revolution was conceived as the solution to people's hunger. The biochemical innovations (HYV seeds, fertilizers, insecticides, irrigation) embodied in the green revolution and technology have been successful in producing huge amount of extra food grains leading to the food self-sufficiency in some big nations like Chaina, India and recently Bangladesh. But over time, it has been quite clear that the gains achieved through the new technology have been concentrated in particular social groups. In terms of aggregate product, the achievement has been quite impressive but in terms of per capita availability of and 'entitlement' to food the situation has rather worsened. In the recent years, gender bias of the agro-based technology has also been recognized as a serious issue in development.

We know that agricultural technology consists not only of those innovations that affect crop production but also those that affect all the operations upto marketing including post-harvest operations, processing of grains, and storage. Since biochemical innovations and mechanization go almost invariably hand in hand, the technical changes create adverse effects on the poorer section of the people, particularly on rural women. As technology may save or generate employment, a

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decision to employ a labour intensive technology may draw women into the labour force, in other cases, it might displace women from their traditional work. The following sections, will highlight the women's position in Bangladesh resulted from technological changes.

Sex-Based Division of Labour in Rural Bangladesh:

The dominant ideology of Bangladesh rural society indicates the notion that the women are not responsible for earning money for the family particularly from the outside. It is within the 'marriage contract' that men are responsible for providing livelihood of their female counterparts and children. The institution of purda plays in important part here in deciding the role of women. Women are expected to remain confined within their home and not even to meet or talk to male visitors coming to the house. The institute of purda strictly allocates indoor work to women and outside work to men (Aziz and Maloney, 1985:76;). Thus, it follows that generally women in rural Bangladesh do not work in the field, but are almost entirely responsible for post-harvest processing of crops, as well as other productive activities like kitchen gardening, poultry and cattle rearing and craft work within and in the proximate of households.

Women's Domestic Work

The rural women in Bangladesh are generally over-burdened with household work. They usually start workingman early age of 7-8 years as their mother's helping hands and gradually take over all the domestic responsibilities once they are married. A wife is responsible for all the domestic work including cleaning, cooking, washing, rearing of children, fetching water, and the like. Thus, women do multiple tasks simultaneously having very often 'double working day', even though their work may remain 'Invisible'. Until recently, these activities performed by women within household were considered 'unproductive' and 'non-economic'. Fortunately enough, the present definition of women's productive work includes income generating activities, expenditure saving activities, and household chores (Farouk, 1980). But this has hardly affected women's position in the society as at the household level, domestic activities are still considered as 'unproductive' work.

Emerging Trends

Now, due to growing impoverishment in rural Bangladesh, many households have lost their capacity to retain their women folk within the homesteads. As a result, an increasing number of both married and unmarried women of the poorer families are accepting paid work outside home. National statistics show that between 1985 and 1989 women participation to labour force in the rural area has increased by many folds from 8.2 percent to 61.6 percent (BBS, 1992:108). The growth in the female agricultural labour force has taken place largely among the women - the women of landless and marginal farm families who are the most impoverished and

disadvantaged groups in the population. Introduction of crop-based technology and Food For Works Programme have opened up new avenues for active participation of the rural women of this group in wage work. They are being increasingly employed in formerly 'male' tasks as a consequence of their cheapness. At present, picking seedling from seed beds and repairing mud roads have become almost specialized jobs for the poorer section of rural women. Besides, in some parts of Bangladesh, particularly in Rangpur and Dinajpur areas, women work in the field performing transplantation, hand irrigation and harvesting crops (White, 1992).

In many parts of Bangladesh, it is found that the women of landless and small farm families work in the field during Boro season harrowing and transplanting. Other field activities of women include sowing seeds, spreading cow-dung, weeding, picking seedlings, carrying seedlings to the plantation place, and so on. Germain, (1976: 2-3) stressed that not only did Bangladesh women work extremely hard at a variety of productive work, but they were being drawn increasingly into new field work, including irrigation and work on new crops. In addition, women also heading toward new agro-based professions. For example, in the fisheries sector, women have traditionally participated mainly as family labour in repairing fish nets, and in some cases, in fish processing. Now, in many areas, women of landless families individually or jointly cultivate fish in leased ponds, either within or near the households.

Thus, we find that in Bangladesh, the traditional gender-based division of labour in the poorer families is undergoing changes due to changes in the agrarian system and general economy. The sage-old purda system is gradually getting ineffective and 'nominal' to the poorer section of people. Women are entering into the area of 'economically productive' work so long monopolized by men. They are increasingly coming out of their homestead and penetrating into wage labour market resulting a gradual change in the distribution of work between men and women.

Forms of Technological Changes and Their Impacts on Rural Women:

Modernization of Agriculture

In Bangladesh, technological change in agriculture started in a modest way in 1961 by the then Pakistan (now Bangladesh) Academy for Rural Development (BARD). Modern biochemical inputs were experimentally introduced in its laboratory area a single Thana namely, Comilla Kotwali Thana by organizing people into village cooperatives. The result was very encouraging and the Government decided to expand the programme through out the country gradually along with other development programme.

In Bangladesh agriculture, new technologies have introduced in crop production, harvesting and post-harvest operations. In these areas, until now, both new and traditional methods are being used simultaneously. Although operations like

ploughing, land leveling, sowing, weeding, etc., to some extent been mechanized. significant mechanization on large scale basis has been introduced only in cases of irrigation, and post-harvest processing. Almost all the post-harvest operations, which had been traditionally the major source of wage employment for rural women, are now being increasingly mechanized. New techniques in post-harvest operations like drying, threshing, winnowing, husking and to some extent storage (in public sector only) have been introduced. In husking and polishing too, both indigenous method (dheki) and the new technology (huller mills) are being use. The technological package embodied in mechanized irrigation, HYV seeds, fertilizers, pesticides being used in crop production has caused an increase in the output by 15 percent to 35 percent (Ahmed, 1975; Islam,1976; Abdullah et.al.,1974 cited in Salahuddin,1986:9).

Types of Major Technologies

Irrigation: Improved varieties of rice and wheat cultivation require timely and adequate controlled irrigation. As a result, the Government of Bangladesh has undertaken a number of irrigation programmes utilizing both surface and under ground water to increase agricultural production. In addition, a number of small-scale, flood control and drainage schemes originated by the Public Work Programme and Food For Works Programme since early 1960s, are also used for irrigation purpose. After liberation, a number of Non-Government Organizations including some International agencies introduced quite a number of small-scale irrigation programmes under their direct supervision and control particularly for the small and marginal farmers.

There are two special projects initiated by two international agencies for the rural poor. (i) UNICEF-assisted Manually Operated Shallow Tube well Irrigation Project and (ii) the IDA- assisted Hand TubeWell Project. Rural women have also been included in these projects and they have been directly benefited. The projects provide women with tube well for the purpose of drinking water and for irrigating vegetables plots. Over the past few years, irrigation with rower and treadle pumps has gained popularity among men and women from near landless and small farmer households who are cultivating vegetables and spices.

Custom Mills: Introduction of simple equipment's for weeding, pest control and fertilizer application has been limited only in few areas of Bangladesh. Women have not been adversely affected by introduction of these technology because these are not female work. Rather, they have created employment for the rural women through an increase in production. But an increasing use of mechanical devices in the post-harvest operations particularly husking and polishing have created a negative impact on the female wage. Increases in production due to changes in the cropping patterns and the introduction of HYVs have led to increased pressure on post-harvest activities. The demand for hired female labour (because post-harvest operations are exclusively women's work) particularly for husking has encouraged

introduction of rice mills in the rural area. Salahuddin (1986:10) on the basis of a survey conducted by the Bangladesh Rural Advancement Committee (BRAC) calculated that if the number of mills increases by 380 per year (which is the lowest figure), the number of women displaced by mills during a year would stand at 100,000. Various other studies on the similar issues revealed the fact that the net effect of rice mill operation for husking at rural area appeared to be significant displacement of women.

Modern Rice Mills: The labour - displacing effect of modern rice mills (auto matic rice mills) is even more devastating than that of the custom mills. This is because it does away with the need of pre-milling manual operations like drying, parboiling, winnowing, etc., in addition to husking operation. It has been calculated that a 'Z' type modern mill can husk about two tons of grains per hour which means displacement of labour force required by nearly three average custom mills. In household terms, this is a huge affair. An automatic mill can, of course, "provide jobs for 18 skilled and 22 unskilled men but at the cost of 1000 women per work place" (Salahuddin: 11).

Impacts and Implications

It may be mentioned here that the above technical changes have different impacts on different classes of rural women. All of them have not been affected equally by the same technology in the similar manner. There are at least three different groups of rural women could be ascertained in the process of technological change who have been affected in different ways. First, female members of large surplus farmers have been benefited from the change in technology, though they did not operate the dheki themselves, they had to supervise hired female labour. Now, they have more leisure time and their families have been benefited economically by displacing dheki wage labour with cheaper milling costs. Second, female members of the subsistence farms who previously themselves operated dheki have been relived from time-consuming and physically demanding labour. Third, wage-labour women from landless and destitute families who did dheki work to augment family income are the only suffering class as a result of this technological change in the absence of any alternative remunerative employment.

This relationship between gender and class may reflect two tendencies. More prosperous rural families withdraw women from agricultural production to show their wealth and prestige, and their ability to hire labour from poorer section. By contrast, women in the poor families are increasingly forced to take paid work in order to meet their survival needs. Here also they face an unfavorable competition with their male counterparts because their wage rates are most often less than half of the male labour. This has a depressing result on the overall labour wage market. The increased competition between men and women for the similar type of work in the rural area has minimized the gap between male and female wage but not by raising female wages, rather by decreasing male wages.

However, one interesting phenomenon regarding the destitute and poor working women has been reported by Scott and Carr (1985:66). They say that in many parts of Bangladesh, these poor women who have no adequate capital even to purchase a dheki, are using the rice mills to their benefit. Many of them have enter into the paddy husking business by buying paddy with the capital they usually borrow from such organizations as Grameen Bank, BRDB women's programme, and so on, and after parboiling and drying get it hulled at the local rice mill. In this way, they can process 3-4 monds of paddy a day, compared to only one mond a day with a dheki. The report concludes that at the current milling rates, and given the larger output, the women are able to earn more per day than would be possible performing dheki work for other people. They are also able to earn higher profit than if setting up their own husking business with a dheki. Thus, it follows that mechanization of paddy processing though displaced rural poor women from employment has also opened up and opportunity for higher earning with less physical work.

However, inspite of the substantial cost advantages over dheki, custom mills are possibly husking only a small portion of the total amount of paddy produced in the country. Of course, availability of cheap electricity might very soon change the situation in such a way that the household husking may loss its competitiveness altogether to the great disadvantage of the poor rural women.

However, there are a few advantages of dheki over rice mills. Not only is the quality of dheki- husked rice considered better as compared to mill-husked rice, the recovery rate from paddy in dheki is also higher compared to rice mills. A survey of some of the government procurement centers in Dinajpur reveals the fact that while the rice mills can recover only about 25 seers of rice from a mond of paddy, dheki recovers upto 28-29 seers per mond (Salahuddin, 1986:18). If the transport cost of paddy to and from mills is taken into account, dheki husking does not seem to be so much at a disadvantage in comparison with custom mills.

Moreover, rural women have been extensively involved in crop processing activities. Technological change in agriculture has further increased their work load. It has been reported that in some areas of Bangladesh, about 50 percent of paid labour opportunities for rural women have come from rice processing in other households. Solaiman (1988) found that the average number of days of hired female labour was

eight times more in villages that adopted HYV seed-fertilizer-irrigation technology than in villages where the level of adoption of improved cultivation technology was minimal.

The above discussion clearly shows that technological changes in agriculture has both positive and negative impacts or rural women of Bangladesh. In one hand, adoption of biochemical inputs has opened up new avenues for agro-based employment for rural women by increasing production and intensive use of land.

Special irrigation programmes for the poor particularly for women introduced by the Government and Non-Government Organizations proved quite helpful for the poorer section of women for improving their economic condition. On the other hand, introduction of husking mills and modern rice mills in the rural areas has displaced a considerable women labour force from their traditional employment. But fortunately enough, the affected women have found out ways to use these mills in their own advantage.

Concluding Remarks

In Bangladesh, women face a lot of problems in participating wage employment outside their homesteads. The institution of purda is the main obstacle in the way of their outside movement. However, their employment opportunities and useful participation in the production process are also restricted by a number of other factors.

a) Women receive much lower wages than their counterparts even for the similar kind of work. This holds good for both agricultural and non-agricultural activities. National statistics shows that wage rate receive by the male labourers in rural area is double for agricultural work and almost triple for non-agricultural work compared to their female counterparts (BBS, 1986). In order to ensure proper use of the rural women labour force, this inequality in the wage rates must be removed.

b) One of the major reasons for female wage differentiation is lower demand for their work. Introduction of rice mills in the villages have further deteriorated this situation through it has some positive aspects too. But mechanization of rice husking has definitely lowered rural women's employment opportunities in the post-harvest operation of rice. One study (Begum and Greely, 1983) shows that 73 percent of the households presently using rice mills had formerly employed female labourer for the task.

c) Rural women can not devote their full time and energy for work due to their 'double responsibilities'. The food habit of the people of Bangladesh involves elaborate cooking which is always done by women. Beside, they are also responsible for washing, cleaning, child rearing, fuel collecting, and the like. For effective participation of the rural women in the wage labour, these issues should be given due consideration. Provision should be made to distribute these workloads between men and women as far as practicable.

The technological change did not affect women of all categories equally. However, it is quite clear that the change has increased over all work load for women labour force particularly during harvest and post-harvest periods, and thereby increased the wage rate of the hired women labour (Ali and Halim, 1988). But at the same time, consumption of women labour force for husking fell from 68 percent to 55 percent and hired labour from 32 percent to 16 percent.

Lastly, it may be pointed out that most frequently mentioned reason for poverty of Bangladesh is the exclusion of women from 'productive' work. Evidence show that this neglected 'fifty percent' could be economically very productive if opportunities are provided. We find that more families than ever before are relying on the income earning capabilities of women. The undiscovered potentials of women might lead the country to the much desired surplus economy if they are properly organized and differential treatments are withdrawn or at least minimized.

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Media And Media Education in Bangladesh: A Perspective for Change

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Abstract

This paper basically aims at identifying the problems in media and media education in Bangladesh. There has always been rift between the press and the government. Because the media are the most powerful means of communication, the government has always tried to maintain some sort of control over print and electronic media. Journalism as practised in Bangladesh, has certain flaws. Newspaper reports in Bangladesh lack both accuracy and objectivity. There are not adequate training facilities for the journalists. The newspapers are not created to spread information but for political or business motives. Therefore, one can not expect objectivity from such newspapers. Owners are also the editors, in most cases, they are not responsible or trained as a professional editor should be, which affects the standard of journalism. Actually emphasis is more on theory than on practice.

Brief History of Journalism in Bangladesh

When the sub-continent was divided in 1947, no daily newspaper was published from East Bengal (present Bangladesh) in spite of the fact that Bengal was the first province in India to come out with a newspaper, the Bengal Gazzette in 1780. In 1949, two dailies, Azad (Bengali) and Morning News (English) were shifted from Calcutta to Dhaka, which then was the capital of the eastern portion of Pakistan. Both of these papers had been supporters of the Muslim League before the partition of the subcontinent. Therefore, they continued to support the Muslim League government which was in power. In the next few years, quite a few papers began publishing from Dhaka. The first was the Pakistan Observer, started in 1949 by a lawyer, Hamidul Huq Choudhury. Later two other Bengali dailies, Sangbad and Ittefaq, began publishing from Dhaka. These three papers were critical of government and may be termed opposition papers as opposed to Azad and Morning News, which always spoke in favour of the government. With the imposition of martial law in 1958, as press freedom was curbed, journalists were harassed and jailed as is often the case with military rule. In 1963, the Press and Publications Ordinance was promulgated. This ordinance is termed as the black law. (Niazi, 1989). In order to have a control over the media, Pakistan Press Trust

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was formed in 1964. The trust published two dailies from Dhaka, the Pakistan Times (English) and the Dainik Pakistan (Bengali) (Niazi, 1986). Since they were government-owned newspapers, they had the resources to employ the best journalists, who set a new trend in the field of journalism by introducing human interest stories. These two newspapers also represented the non-Bengali interest in former East Pakistan. In 1964 an English weekly, Holiday, was started. It was a radical newspaper that still has quite a good circulation among the elites.

During the nine months of our liberation war in 1971, underground press was very active. Innumerable newspapers were published, but not on a regular basis. They had a very high readership. They were published from both inside Bangladesh as well as from the liberated areas. This clandestine press was very active during the liberation war in projecting the views of the Bangalees. But once the country became independent, they ceased to exist except for one, Banglar Bani, which continues today as quite a successful newspaper.

The Press and the Government

There has always been a rift between the press and the government. Because the media are the most powerful means of communication, the government has always tried to maintain some sort of control over them. In 1974, when the country switched over to a one party system, it was not considered expedient to allow freedom of expression. Therefore, by an act of parliament, Special Powers Act 1974, all newspapers in the country were banned except four that were taken over by the government. Democratic governments have been little more tolerant. They have removed some of the restrictions on press. But press freedom as understood in the West does not exist in Bangladesh. Technically speaking, at present we do not have laws that restrict press freedom. But the existing laws are misused to manipulate the press and to harass journalists. On the slightest pretext, defamation suits are brought by the government and warrants of arrest are issued against the particular editor or newsman. Filing of defamation cases under section 500 of the Bangladesh Penal Code appears to have become the favorite, mainly of government officials, in displaying their anger with newspapers. Perhaps this is because the journalist can be harassed and humiliated by just initiating a case under this law (Samad, 1989,p. 47). Journalists are often subjected to physical assault by the police. On June 21, 1992, police attacked a group of journalists. At least 24 journalists were hurt when riot police chased and beat the media members. They also fired teargas and bird shots into the crowd (IPI Report, 1992,p. 22(1)). Besides police attacks, the journalists and their offices are often subjected to violent attacks by hooligans who are afraid of being exposed by the media, (Samad, 1989,p.47). A group of armed hooligans attacked the office of a daily newspaper on March 28, 1992 in which four newsmen were injured (Telegraph, 1993). There is another kind of interference from the government that is more subtle. It is more pronounced in radio and television. Verbal instructions are issued by the Ministry

of information to focus on a particular leader or to smother any opposition news. Because radio and television are controlled by the government, these instructions have to be carried out.

Ownership, Trends and Issues

The newspapers in Bangladesh can be divided into three categories. One category would be newspapers under private ownership. Daily Star, Bangladesh Observer, Sangbad and Ittefaq would fall in this category. These are centrist newspapers which do not support any particular political party. Another category of newspapers are those like Bangladesh Times and Dainik Bangla which belong to the government press trust. These papers only project the government's viewpoint. The third category would be newspapers that are put out by the political parties like Sangram or Millat which function as their party's mouthpiece.

We have a total of 853 publications. Of these, 172 are dailies, 567 are weeklies and 114 are fortnightlies. The capital Dhaka alone has 22 dailies and 59 weeklies. Chittagong, the second largest city, has four dailies and Rajshahi three. There are two news agencies, the Bangladesh Sangbad Sangstha (BSS) and the United News of Bangladesh (UNB). The UNB is privately owned. Since the literacy rate is only about 25%, the readership is low. In a population of 112 million, the total circulation of newspapers is about half a million. Ittefaq has highest circulation of newspapers, about 194,560. Among the English dailies, the Bangladesh Observer ranks first with 60,000, followed by the Daily Star. Ittefaq's high readership is probably due to the fact that in spite of being a Dhaka-based newspaper it also covers the rural areas. It may be pointed out that in last few years the number of newspapers has mushroomed. The reason is that with the previous government of President Ershad, it was difficult to bring out a newspaper. With the return of the democratically elected government in 1991, the situation has changed. In 1989-91, the total number of publications was 795 and in 1992 the figure stood at 853.

Politics is very important in our country, therefore, newspapers give more coverage to political news. Development news (health, population, science or agriculture) or human interest stories become secondary. Government advertisement are the major source of revenue of all the newspapers. A daily newspaper consists of eight pages with eight columns. The cost of a newspaper is 10 cents. It carries 60% news and 40% advertisements. Recently newspapers have been computerized. An English daily, the Daily Star has just introduced colored photos and headlines.

Problems

Journalism, as practiced in Bangladesh, has certain flaws. Our newspaper reports lack both accuracy and objectivity. Instead of interpretative reporting what we have is the personal opinion of the writer. The reporters fail to understand the difference between information and comment and combine the two. Follow up stories and in-depth reporting are hardly done.

There are quite a few reasons for this low standard of journalism. The first is the lack of good reporters. One reporter has to cover many subjects. Therefore, he is unable to specialize in any particular subject. Second, there are not enough adequate training facilities. Third, the courses that are offered in the Department of Mass Communication and Journalism are more academic. Emphasis is more on theory than on practice. The Press Institute of Bangladesh (PIB) and the National Institute of Mass Communication (NIMCO) offer training courses to journalists, but it is inadequate. Fourth, the newspapers are not created to spread information but of political or business motives. Therefore, one cannot expect objectivity from such newspapers. Fifth, owners are also the editors. In most cases, they are not responsible or trained as a professional editor should be, which affects the standard of journalism. In the recent years, there has been a dramatic growth of newspapers, which has greatly affected the standard and ethics of journalism. Most of these journalists are inexperienced and the owners have no professional experience (Telegraph, 1993). "Absence of experience and orientation, excessive partisanship and parochial interest may lead to distortion of information, biased reporting and baseless story-telling" (Telegraph, 1993, p. 69). Sixth, since our economy is not developed, all newspapers have to depend on government advertisement. If any report displeases the government, that particular newspaper is deprived of its quota of advertisement. Therefore, bold journalism can never be practised as long as the newspapers are dependent on government advertisements. Finally, another way that the government exerts control on the newspapers is through the supply of newsprint. The quota of newsprint of a newspaper is not based on its circulation but rather on the decision of the Ministry of Information. Because the government is the only supplier of newsprint, the newspapers generally do not want to displease the government for it would affect their quota.

Electronic Media:

Television

Bangladesh television's history date backs to 1964 when Bangladesh was a part of Pakistan. Television is controlled by the government. There is only one television station, the Bangladesh Television (BTV). Bangladesh Television telecasts 54 - 5 hours of national programe weekly, of which 9.20 hours is devoted to news. The focus is more on entertainment rather than on educational program. On week days, the BTV telecasts American drama serials like Dynasty, A-Team or Dallas. English movies, mostly American shown once a week. Bengali movie is shown once a month and on special occasions. The news focuses more on the activities of the government and the ruling party, the BNP. Opposition news is not given much coverage. News of other areas of Bangladesh is not given much coverage unless it involves the ruling party. As for international news, it is mostly a replay of what has already been shown on CNN or the BBC. Regional news concerning South Asia is not given much importance. Besides BTV, we can view CNN and

BBC for three and half hours each in the morning and afternoon (except for Friday). We also have access to Star TV through the dish antenna. But it is limited to a section of affluent people.

Radio

During the liberation war, a radio station as set up Mujibnagar, which greatly boosted the morale of the Bangalees (Ahmed, 1993). With the independence of Bangladesh, Radio Pakistan in Dhaka came to be known as Bangladesh Betar. In 1974, the name was changed to Radio Bangladesh. Besides Dhaka, Radio Bangladesh has six other regional stations at Chittagong, Rajshahi, Khulna, Sylhet, Rangpur and Rangamati. Radio Bangladesh has 14 medium wave transmitters with 1590 kilowatt radiating power. It also has five short wave transmitters with more than 700 kilowatt power and 14 FM transmitters with more than 700 kilowatt power and 14 FM transmitters of 14 KW power which enables the station to establish link between the Broadcasting House and transmitters (Ahmed, 1993).

Radio is more popular in the rural areas. Its audience is much higher than the television or newspapers because it does not have to depend on electricity. With the popularization of transistors, radio programs reach the remotest corner of the country. Its audience is more in the rural areas and they matter very little in decision-making policies. Radio offers a wide variety of programs that includes entertainment, cultlural, musical and educational. Radio broadcasts more educational programs than does television. Radio advertisements have a greater appeal in the rural areas. As for news, it is not much different. The focus is more on the ruling party.

Journalism Education in Bangladesh:

Until recently Dhaka University was the only university in the country offering Journalism courses. It started in 1962 as a one-year graduate Diploma course. In 1968, a Master's course was added. The growing importance of journalism in the modern world led the journalism educators to introduce a three-year Honours course and the Department was renamed as the Department of Mass Communication and Journalism. The courses that are offered in the Department are a mixture of the Wisconsin model as well as the Missouri model. We believe that in order to be a good journalist, a person should not depend only on journalism courses but should widen his horizon of knowledge by taking some theory courses. Therefore, right from the beginning, a student takes theory courses along with journalism courses. In the three-year Bachelor of Arts program, sixteen courses of 50 marks each are offered. In addition, two other courses are required. One is a comprehensive and the other an oral exam. Besides these, a student has to choose two other subjects as a minor. Since language is very important for journalism, therefore, one of the minor subjects has to be either English or Bengali. In the first

year of the Honours course. Principles of Journalism is offered. The course deals with the ethical side of journalism and provides the students with an insight into the subject. In the second year, reporting as well as editing courses are offered. In the third year, also higher level of reporting and editing courses are offered. Advanced Reporting and Editing courses are offered at the Master's level. At the Master's level, a student can specialize in one of the six fields that is offered. They are feature writing, public relations, advertisement, newspaper management, communication and policy planning and electronic media. In spite of our limited resources, we try hard to impart a good journalism education. We are aware of our shortcomings, but there is very little that we can do. The following can be identified as reasons for the shortcomings:

Quality of Students

The Department of Mass Communication and Journalism does not select students for the course. The admission is conducted by the University authorities. Hence a student may qualify at the admission test but not necessarily be qualified to study journalism. He or she may be lacking in writing skills. Furthermore, perhaps the student may not be interested in pursuing journalism education but has no other choice. Finally, he or she may not have the desire to become a journalist. He or she is just in the department to get a graduation diploma which will enable him or her to sit for the competitive examination which is more alluring. Hence, he or she is not inclined towards the course.

Financial Constraints

Financial constraints prevents us from utilizing a lot of facilities. We are unable to offer typewriters to a single student at a time when journalism students elsewhere have access to computers. They have no access to modern technology. Even a monthly newspaper put out by the students is beyond our means. Therefore, education is basically limited to theory. We are unable to provide them with recent books. Hence they have to rely on books published in the seventies.

Training of Teachers/Educators

If there were programs that would enable the educators to be trained and be acquainted with modern methods of teaching journalism, it would be beneficial for the students.

Communication Gap

There is a communication gap between the department and the newspaper industry. The professionals suffer from a misconception that our education is academic and has no relation to reality. But this is not true. Our professionals have not received formal journalism education, so it is natural for them to be

apprehensive about our journalism education. In fact, the journalism they practise does not follow accepted journalistic standard. Perhaps, a dialogue or seminars or workshops between newspaper editors, working journalists and academicians could be useful.

Teacher-Student Ratio

Another problems that we face is that there are too many students. The student-teacher ratio is too high. It is impossible for a teacher to handle 75 students in a reporting class and to check each assignment especially when reporting happens to be one of the three or four courses he or she has to teach.

Journalism Education in Other Institutions:

The Mass Communication Department in Rajshahi University is comparatively new. It started in 1992. They have a three-year Honours program and a one-year Master's program. Its course contents are similar to the Dhaka University's.

Chittagong University has just opened a Journalism Department, but it has not yet started functioning.

Press Institute of Bangladesh, popularly known as PIB, is an institute set up by the government to provide training to working journalists. PIB offers three kinds of training programs. One is for the young journalists who have not been in the profession long. The other is for the mid-level journalists and another for the senior journalists. These training programs are held in the capital city Dhaka. PIB has another training program for out-of-town journalists. These workshops are held in the smaller towns. Sometimes professors from the Department of Mass Communication and Journalism are instructors in these workshops. Besides these, sometimes foreign journalists specializing in a particular field are invited to Dhaka to conduct workshops. PIB workshops deal with the print media.

The National Institute of Mass Communication (NIMCO) is another institute set up by the government for training of journalists but they concentrate on television and radio.

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Land Use and Land Management as Influenced by Technological Development in Rural Bangladesh

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Abstract

This paper gives a broad overview of current use and management issues of agricultural land in the context of technological development in Bangladesh agriculture. Technological innovations have been grouped into a set of clusters and their impact on land use has been measured in terms of land use eficiency. The technological cluster-genetic upgrading- has been found to cause the maximum increase in land use efficiency (LUE), while the increase in LUE due to cropping systems, although significant, varies within a broad range. The major land management issues, such as soil degradation, organic matter breakdown and depletion of soil fertility accentuated by technological developments have been discussed.

Introduction

Land is one of the key resources that came undr intensive exploitation since the advent of high energy input technology in Bangladesh Agriculture. Over the last three deades, the arable area including land under permanent crops increased at an annual compound rate of 0.15% and the area under protective forest cover and wood land declined at 0.88% (IRRI, 1990, p.320). With the expection of the risk prone charlands and the unstable forested hill slopes, there is little room for the horizontal expansion of agriculture.

The total land area of Bangladesh is about 14.48 million hectares (mha) of which 12.31 mha are total soil area, 0.97 mha are rivers, beels and other closed water bodies and 1.94 mha are under homesteads and urban uses (FAO,1988). The net area under cultivationis estimated at 9.03 mha (MPO, 1985). Of this amount, 47.2% area is single cropped, 40.2% area double cropped and 8.3% triple cropped. Since 1968-69, cropping intensity grew at an annual rate of 0.67% and now stands at 159%, a figure much higher (118%) than that in India (Karim, 1988). Pressure on productive use of farm land grew because of fragmentation of land holdings and

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a surge in the number of landless and functionally landless farm holdings that constituted 52.9% of all rural households as against 6% in 1977 (BBS, 1986). The per capita availability of land comes to only 0.09 ha compared to 0.22 ha in India and 0.79 ha in USA (Pathak and Gomez, 1991) and the average size of farm holdings is 0.91 ha (BBS, 1991, p.201).

During the period 1965-90, agricultural production in Bangladesh grew at an annual rate of 1.8% and output of grain cereals recorded a bit higher growth rate (2.4%), but still it fell short of matching the population growth rate of 2.6% per annum. The average index of food production per capita declined steadily and in 1987-89 it was 93% of the baseline in 1979-81 (World Bank, 1991, p.290). The impressive cereal harvest of 19.5 million tons (MT) in 1989-90 had to be supplemented with 2.2 MT of cereal imports and 1.2 MT of food aid in cereals to meet the demand for foodgrains. But, nevertheless, the success in achieving a substantial increase in indigenous food production was largely a result of infusion of modern technology that involved increasing use of chemical fertilizers, pesticides, irrigation water and improved seed varieties. The use of these purchased inputs caused production opportunities to change and added new dimensions that influence farmers' decisions on land use and land management.

Objective

The basic objective of this paper is to trace certain opportunities and constrains of land use and land management as new production technologies get diffused through the farming community in Bangladesh.

Materials and Methods

The analysis presented here is based on data collected from recent rsearch reports of different institutes of the National Agricultural Research System (NARS). Besides, an observation-participation method consisting of field monitoring of farming system research and development (FSRD) programmes at different agro-ecological regions of the country and discussion with scientists following an informal interview schedule was employed to gather relevant information for use in the study. Agricultural production technologies developed through research were grouped into a set of technological clusters: genetic upgrading, biological nitrogen fixation, fertilizer management, irrigation water management, planting techniques, and cropping system. The impact of farm prduction technologies on land use was estimated by calculating land use efficiency (LUE) as suggested by Canter (1986, p.382). LUE indicates the proportion by which the productivity of cropped land per unit area is enhanced by technological innovations. The major issues pertaining to land management in the context of technolgical development are discussed in the light of observations gathered during field monitoring of FSRD programme.

Results and Discussions:

Impact of Farm Production Technologies on Land use Efficiency

Table 1 summarizes both qualitative and quantitative information on six crop production technological clusters relative to estimated increase in land use efficiency and estimated increase in efficiency of natural resource use (fossil fuel and water).

The cluster genetic upgrading refers to all types of genetic manipulation designed to improve plant varieties. Modern varieties (MVs) that now account for 30% of total rice area and 45% of total rice production are estimated to cause increase in land use efficiency (LUE) by 132.6% in Aus, 107.4% in Aman and 98.9% in Boro rice growing seasons. The usage of MVs is about 100% for both irrigated and rainfed wheat that are expected to cause an estimated 125.5% increase in land use efficiency. Modern varieties are used for 63% of potato area with an estimated LUE of 71.0%, for 73%of jute area with an LUE of 80% and for 60% of sugarcane area with LUE between 29.0% and 53.0%.

Enhancement of biological nitrogen fixation in the soil, particularly in the root zone of the crop, constitutes one of the greatest opportunities to improve production efficiency of all crops, especially the legumes, and to reduce high energy inputs in the form of chemical fertilizer. Nitrogen fixation mediated by association of locally isolated strains of Rhizobium bacteria with legumes is expected to increase LUE by 25-75% in groundnut, 20-25% in chickpea, 50-185% in soybean, and 20-25% in lentil. Rhizobium sources along with azolla in rice fields is expected to increase efficiency of fossil fuel use through cutting back fertilizer use by 39-52%. Biological nitrogen fixation through growing a green manure crop in the cropping systems may cause as much as 89% increase in the efficiency of fossil fuel use.

The cluster fertilizer management refers to application of recommended levels of fertilizer nutrients at balanced proportions. Available evidences suggest that this technological cluster holds potential of increasing considerably land use efficiency as well as boosting the yield of the harvested portion of the crop per unit of fertilizer nutrient applied (fertilizer use efficiency). The estimated increase in LUE is 64.8% for Aus, 87.5% for Aman, and 40.2% for Boro rice. Fertilizer use efficiency is estimated to shift upward for potato by 121.4% for wheat by 71.8%, for Boro rice by 65.0% and for jute by 57.5%.

Water management technologies that are now available offer the potential for increasing LUE for Aman by 20-45%, for wheat by 20%, for potato 30-40%, for mustard 20-30% and for sugarcane 40-50%. Planting techniques, particularly minimum tillage and zero tillage, have been developed that conserve post-monsoon residual soil moisture to take advantage of seeding dry-season crops

within optimum time. Available results show that growing wheat with minimum tillage can increase LUE by 8-11%, while zero tillage can be effective in increasing the value of LUE by 22.6% in potato and 4.7 - 64.0% in maize.The spaced transplantging technique of sugarcane plantingis expected to cause 19.7 - 37.9% increase in LUE for sugarcane.

Cropping systemas a technological cluster has been a recent development that offers the best opportunity of maximizing land use: exploiting land productivity through multiple cropping and efficient use of fertilizer and irrigation. The technology creates demand for labour and responds to farmer's resource constraints. In general, the cropping pattern that includes two to three crops in the year-round crop cycle is common in high and medium high lands. Patterns with one or two crops are mostly common in the low lands. Cropping - system based technological cluster can be broadly subdivided into three groups: (a) shift to modern varieties for one or more crops grown in farmers' traditional pattern with improved crop management practices. (b) shift to modern varieties along with inclusion of a new crop in traditional patterns (c) shift to modern varieties and substitution of a crop in the existing system by a new one. Replacement of local varieties and land usage by modern varieties is estimated to increase in LUE by 20.8 - 46.9%. When the change over to modern varieties is supported with accommodation of either a green manuring or food crop in the existing cropping systems, the cumulative effect may give an estimated 20.0 - 188.2% increase in land use efficiency. The impact becomes even more prominent with an estimated rise of LEU by 66.4 - 281.2% when a high value new crop substitutes an old one and farmers use modern varieties for most of the crops grown in their cropping systems.

Issues of Land Management in the Context of Technological Development

Modern technology leads to intensive uses of land resources and it is in this context that land management becomes crucial in order for agriculture to sustain continued growth. The major land management - related issues that the scienctists felt are fallouts of intensification of cropping were : intensive tillage, pouddling of soil in wetland rice culture, water logging, soil erosion, mining of soil fertility and micronutrient deficiency, shifting cultivation, and spread of shrimp culture. However, all these issues can be broadly divided into tow types: soil degradation and man-made hazards that cause imbalance in agro-ecological environment.Soil degradation refers to decreased land productivity due to reduction in the quality of the soil's life-support processes that include physical, chemical, and biological deterioration. Intensification of rice cropping frequently with more irrigation water than actually needed casuse the land to remain under water for most of the year. This creates waterlogging that profoundly changes important bio-chemical properties of the soil affecting the availability of plant nutrients and activity of soil

biota. Moreover, intensive tillage operations - usually an average of six ploughings followed by six to seven laddering under waterlogged conditions cause puddling of the soil that effectively breaks down all aggregates.

The breakdown of aggregate/structure makes the soil liable to compaction by traffic and farm implements. This compaction in turn leads to less water entering the soil below the compacted layer, restricts root growth and cause waterlogging that adversely affects the performance of dry land crops grown after rice. Besides, puddling of the soil contributes to deficiency of nitrogen in the soil and also causes deficiency into other vital plant nutriens - Sulphur and Zinc.More than 4 million hectares (mha) of arable land in Bangladesh are deficient in sulphur and approximately 2 mha are deficient in zinc. Intensive tillage operations for each crop accelerates breakdown of soil organic matter - the basic determinant of soil health and major source of plant nutrients. In contrast, little fresh organic material is added to soil as farmers are forced to burn a major portion of farmyard manures, composts, and plant residues as fuel. The net result is gradual depletion of soil organic matter that encourages mining of soil fertility.

About 60% of the net cultivable area mostly in high and medium high lands have organic matter content less than the critical limit (Karim, 1988). The use of chemical fertilizers to improve soil fertility now constitutes to the tune of 1.5 million tons. This amount is adequate to provide 0.65 million tons of nutrients that replenishes only 37% of what the harvested portions of major field crops annually remove from the soil. Besides, farmers seldom recognize the need for application of fertilizer nutrients at balanced proportions that cause the input-output ratio for certain important nutrients to drop more rapidly that further aggravates declining soil fertility.

The ploughing of farm land in Madhupur Barind Tract and Northern Piedmont Plains causes loosening of soil that becomes subject to erosion during monsoon rains.The impact of soil erosion is more prominent in hilly areas. In a study conducted by Hill Tracts Agricultural Research Station in Ramgarh, the amount of soil loss from hill was found to increase with the increase of slope percentage and the severity of erosion was more pronounced in along the slope cultivation than in across the slope cultivation (Tabel 2). In across the slope cultivation, the amount of soil loss was 1.39 t/ha in 5% slope and 27.72 t/ha in 50% slope. In case of along the slope the amount of depleted soil was 2.29 t/ha that increased to 42.87 t/ha in 50% slopes.

The local people of Chittagong Hill Tracts who practise jhum cultivation can now afford only three to five years for the land to remain fallow, a period that is too short for the soil to regain its original fertility through regeneration of natural vegetation. This causes the land once protected by dense forest cover to turn into less productive covered with scattered grasses and weeds and prone to increased erosion hazards.

The growth of shrimp industry over the past decade has led to conversion of an estimated 1,00,000 ha of crop land in the coastal region for seasonal or annual shrimp production. While, shrimp culture even with the present low level of technology still gives higher net return than rice cropping, it contributes to intrusion of salinity in the adjacent areas that makes them less fit for crop cultivation. Besides, in the process of creating conditions favourable for shrimp cultivation, the influential owners of shrimp business submerge a large adjacent area with brackish water that also includes the land of small farmer who can't afford investment in shrimp business nor can they prevent shrimp gowers from flooding their land forcibly. This has forced many thousands of small farmers to abandon their land and become virtually landless.

Conclusion

This paper highlights some broad issues relating to land use and land management in the context of technological developments in Bangladesh agriculture. Technologies have been grouped into a set of clusters to assess their impact on land use efficiency (LUE). The cluster genetic upgrading ranked the top in terms of achieving the highest level in LUE followed by fertilizer management and cropping systems. The major land management and cropping systems. The major land management issues that the scientists feel have become acute in the wake of introduction of technological innovations are: intensive tillage, soil puddling in continous wetland rice culture, rapid breakdown of organic matter, mining of soil fertility, soil erosion, and encroachment of salinity due to expansion of shrimp culture in coastal areas.

Table-1: Impact of Crop Production Technological Clusters

Technological cluster	Crop	Increase in Land use efficiency (%)	Increase in resource use effieienty
Genetical upgrading	Rice: Aus	132.6	Not estimated
	Aman	107.4	
	Boro	98.9	
	Wheat	125.5	
	Jute	80.0	
	Groundnut	50-61.5	
	Mustard	53.0-73.0	
	Chickpea	35.0-50.0	
	Sugarcane	29.0-53.0	
	Potato	71.0	
Biological Nitrogen Fixation	Groundnut	25.0-75.0	Fossil fuel in producing chemical fertilizer through a) developing Rhizobium and azolla Sources: 39-52% b) Incorporating into soil a green manurecrop : 89.6%
	Chickpea	20.0-25.0	
	Soybean	50.0-185.0	
	Lentil	20.0-50.0	
Irrigation water management	Rice : Aman	20.0-45.0	Water use through lining irrigation channel 5%
	Wheat	20.0	
	Potato	30.0-40.0	
	Mustard	20.0-30.0	
	Sugarcane	40.0-50.0	
Fertilizer Management	Rice: Aus	64.8	Fertilizer use efficiency (Kg/kg). Mustard 15.9 Jute 57.5 Potato 121.4 Wheat 71.8
	Aman	87.5	
	Boro	40.2	
	Wheat	39.9	
	Potato	23.6	
	Mustard	64.0	
	Sugarcane	114.2	
Planting Technique a) Zero and Minimum tillage	Wheat	8.00-11.0	Not estimated
	Potato	22.6	
	Maize	4.7-64.0	
b)Spaced Transplanting Technique	Sugarcane	19.7-37.9	
Development of cropping systems a) Varietal shift in existing cropping patterns		20.8-46.9	Not estimated
b) Varietal shift plus inclusion of a new crop		20.0-188.2	
c) Varietal shift plus substituting an existing crop by a new one.		66.4-281.2	

Source: Estimated from current research reports of BRRI, BARI, BJRI and SRTI.

Table-2 : Amount of Soil Loss in Differnt Slope

Slope (in %)	Soil losses (t/ha)	
	Across the slope plantation	Along the slope plantation
5	1.39	2.29
10	3.33	6.04
20	6.25	10.29
30	10.42	13.71
50	27.72	42.87

Source: *Annual Report*, Hill Tracts Agricultural Research Station, 1991-92

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Social Costs of Large Scale Industries

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Abstract

Modern industries of advanced technology involve social costs to a large extent giving rise to the environmental pollution in the form of air, water and noise and social pollution like slums and their related evils and these social costs are not reckoned within the usual accounting procedures. Excessive emission of smoke from the industries contains pollutants like SO_2, NO_2, CO, CO_2 etc. are very much harmful to health and lead to the catastrophic situation like London smog of 1952 which was responsible for the death of 4,000 people. In America, it has been estimated that the cost of treatment of water contaminated by the textile mills is about 20% of the total value of output. The purpose of this paper is to set a stage for discussion on the social costs of large scale industries so as to consider it as an important component of total cost calculation.

Concept of Social Cost

It has been argued that social costs are the concomitant of any process of rapid industrial growth. The rapid growth of industries and the speedy increase in the per capita energy consumption are very much interrelated. The rapid industrial growth and the consequent increase in the demand for fuels like coal, gas, oil and nuclear energy involve several types of costs. These costs can be classified into two categories. One is internal cost which is born by the producers in the form of monetary payments and ultimately transfered to their users. The other costs are external costs, which lie outside the sphere of the monetary pricing of products and services and arise when there are discripancies among those bearing the costs and those receiving the associaed benefits. For example, the firm whose factories pollute the atmosphere, receives benefits and does not bear the costs of cleaning the buildings in the neighbourhood nor does it meet the extra costs of health care incurred by those who breath the polluted air.

The term 'Social Cost' covers all direct and indirect losses sustained by third persons or the general public as a result of unrestrained economic activities. These social costs may take the form of damages of human health, they may find their expression in the destruction or deterioration of natural wealth, they may also be caused by different industrial activities as appreciated by specific environmental

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responsible for the impairment of less tangible values. That is, any type of inconvenience that a person feels in fact, contributes to the social cost of the production process.

Social costs arise in various ways. The origin of the social costs can be found out in the activities of some specific industries and can be treated as due to particular productive processes.There are some other social losses that occur because of the interaction of so many factors and make the process of causation complex. Some of the social costs of production could immediately be identified and some may not be so perceived. As a result, an affected person has not immediately become aware of such costs. Some of the social costs affect only a group of individuals while others affect each members of the society equally at a time. Furthermore, in some cases damage may be widely spread and could affect many people at a time. In such a case, resulting total losses may be enormous. though the losses that an individual has to bear may be relatively small. Although aware of his losses, the individual may not even consider it worth while to take action against the particular industry responsible for his losses. In short, the social costs are those costs which other persons or the community sustain as a result of modern production processes, and for which private enterpreneurs are not held accountable. If the causal relation between the various industrial activities and the social costs are critically examined, the costs can be minimised or avoided by appropriate measures. For example, pollution of the environment by various types of contaminants can be treaced to certain productive activities and can be shown to be man-made and avoidable. Basically the social costs are incurred because of the profit maximising behaviour of the business entrepreneurs which lead to the minimisation of the private production costs at the expense of social sufferings. Therefore, greater the reliance on the profit making activities greater will be the potential social costs arising through activities. The main objective of this paper is to set a stage for discussion on the social costs of large scale industrises so as to consider it as an important component of total cost calculation.

Types of Social Costs Usually Involved in the Large Scale Industries

Social costs due to the large scale industrial activities can be classified into two categories. One arises due to the environmental pollution which includes the pollution of air, water and noise and the other is the outcome of the social pollution which includes the emergence of slums and other related evils and the overall degradation of human life.

Air is a very important component of environment. Air pollution is not a new problem, but with the advancement of technology air pollution has become an acute problem, especially in the industrial cities. Air pollution is not equally damaging and uniform in its effects in all industrial centres. The metropolitan cities are no less affected by the menance of air pollution. The pollution of air caused by different industrial activities is aggravated by specific environmental

factors of which climate and topography are much important. The researches which have been carried out in this century have pointed out that the concentration of pollutants in the atmosphere depends upon the interaction of (a) the quality and quantity of pollutants emitted; (b) the rate of dispersion of the pollutants and (c) the chemical and physical reactions which alter the pollutants in the air. (Kumar, 1982). But it is not possible to say that all the interactions of factors have fully been explored and it is also not possible to claim that all the pollutants and their respective effects have already been identified. In addition to this, it is also not possible to say that sufficient knowledge is available to draw the conclusion with respect to the social costs introduced by the industrial activitis.

The quality and quantity of pollutants emitted into the atmosphere is clearly related with the concentration of the industries in a locality, the growth and consolidation of metropolitan areas and the increase of population. Industrial activities in the localities give rise to the discharge of a variety of waste materials in solid, liquid or gaseous forms into the atmosphere which are themselves polluted or which become pollutants after chemical reactions have taken place in the atmosphere. This polluted air has a great adverse effect on human health.

Human body requires a certain volume of oxygen and to sustain its requirement the body of average weight (120 lb) requires something like 50 lbs. of air per day. If the world population is 5 billion, then about 250 billion lbs. of air will be necessary for breathing by mankind everyday. Table-1 shows man's biological air needs per day.

Table-1: Man's Biological Air Needs (by a man of weight 120 lb.)

Situation	Air Need (lb. / day)
Resting	20.7
Light work	78.3
Heavy work	121.0

Source: Department of Chemical Engineering, I.I.T. Kanpur, 1987

The average consumption of food of a man is about 3 lbs. per day. In normal situation (in the situation of resting and light work) man takes in about 15 to 20 times the amount of air compared to food. Therefore, the degree of freshness of air has enormous importance for the sake of human, plant and animal life.

Among all the pollutants, gaseous and particulate pollutants are mainly the emmissions of industrial units. Combustion of fossil fuels emits the gaseous pollutants like carbon-dioxide (CO_2), carbon monoxide (CO), oxides of nitrogen

NO_x, hydrocarbons (HC), sulphur dioxide (SO_2) etc. Their concentration is increasing day by day in the ambient air with the increase in the consumption of fossil fuels.

In U.K. it is estimated that the present rate of increase of the concentration of CO_2 is about 0.7 ppm (Particles per million) per year. It has the property to absorb heat radiation of the sun and accordingly more of its presence in the atmosphere will absorb more heat and pollute the atmosphere. It is said that CO_2 might rise to 18% by 2000 A.D. in U.K. as a result of the burning of fossil fules, leading to 0.5^0 C temperature rise (Eden, 1982).

At the concentration level of 1-5 ppm, SO_2 causes bronchial irritation. It forms sulphuric acid when it gets mixed with water and that is very much irritating for all living objects. This reaction is promoted by the presence of nitric oxide. Studies have shown clear correlation between deaths from bronchitis and SO_2. To these there must be added the cost of damage to buildings by the sulphuric acid washed out due to rains. With water, NO_x forms a high irritating mix of nitric acid. Decomposition of NO_2 in the presence of light by hydro-carbons may cause photochemical smog. CO constitutes the single largest pollutants in the urban industrial environment. It is very much poisonous even at a very low concentration level. Exposure to a concentration of 1000 ppm could lead to a person becoming unconscious in one hour and his death within four hours. particulate emission is amother component of pollution which interferes with the transmission of heat from sun to earth, by reflecting a portion of the sun rays away from the earth. It helps formation of smog which is responsible for the emergence of many problems. It provides sites for the absorption of other pollutants which ultimately find their way into the lungs.

It is observed that the total coal consumption of industries of Kanpur city of India is about 1.25 million tons per year (I.I.T. Kanpur, 1987). To convert one ton of coal to energy requires 5,333.44 lbs. of oxygen from the air. Therefore, the complete combustion of 1.25 million tons of coal takes 6.667×10^6 lbs. of oxygen from the air annually. Thus, for the burning of 1.25 million tones of coal per year, the air of the concerned locality lose 6.667 million lbs. of oxygen per year. That is, the air is losing its purity to that extent. Table-2 shows that one ton of coal burning produces 100.005 lbs. of most important gaseous pollutants in the air. Therefore, this combustion process emits 125 lbs. of gaseous pollutants in the air and truely puts two sided presssure on the tolerance margin of nature.

It was found that 264 million tons of pollutants were emitted into the air over the United States of America in the year 1970 (Parkins, 1974). This is more than 2,256 lbs. per person each year. The share of industrial emission in that pollution is estimated at about 30%.

Table-2: Gaseous Pollutants Emission Factor per Ton of Coal Burning (in lbs) from Industrial Plant

Pollutants	Amount (lbs/Ton)
Nitrogen Oxide (NOx)	20.0
Sulpher dioxide (SO2)	76.0
Carbon monoxide (CO)	3.0
Hydrocarbon as Methane (HC)	1.0
Aldehydes	0.005
Total	100.005

Source: Department of Chemical Engineering, I.I.T. Kanpur: 1987

In man air pollution exposure clearly aggravates existing respirtory problems and probably heart problem as well. There is evidence that it increases susceptibility to infection. In plants, air pollution can reduce productivity leavels and damage or even kill plant tissues. Acid rain can leach important minerals from the soil, reducing forest productivity.

We have a long history of air pollution in the industrial countries and it is the history of increasing concentration from emission in industrial areas. Therefore, it gives us urgent cause for concern. But why is not something done ? Halliday in 1961 has quoted an anonymous writer of a British Journal of 1889 as below:

'He had pointed out that (a) smoke was a by-product of an activity which commanded the attention and the support of all financial interests in the country because it produced goods and profits, and therefore the willingness to give thought to the smoke aspect of the activity was very limited; (b) the damage done by smoke, though very considerable throughout the country was not very clearly visible to the individual smoke producer, because it was widely spread, so that interest in the reduction of smoke was lacking; and (c) since the damage done by smoke was due to a very large number of small producers of smoke, a clear relationship between cause and effect was difficult to establish'.

The above quoted part was written 100 years ago, but still it has the validity for the pollution problem. Smoking and smokestacks means profits and that is why the producers of smoke nuisance do not bother for the sufferings of the society. The problems of arir pollution continued to worsen in the industrially developed countries and some times it crossed over the national boundaries and polluted the

environment of the neighbouring countries. In particular, power stations of U.K. and some other European countries have been blamed for increased air pollution in Scandinavia. The smoke Abatement League (U.K.) heard Dr. Des-Voeux about smoke-fog death in 1905 and 1911 and it is likely that the word 'smog' was derived from his work. In this connection some information on disasters caused by excessive smoke from the energy use which took place in some of the large cities of the world in the recent past deserves mention

The December 5-9, 1952, London fog is the best known air pollution episode in England. Table -3 demonstrates some significant dates in the history of air pollution. The ' Killer Smog' began in London area, particularly SO_2 level built up because of

Table-3: Significant Dates in the History of Air Pollution

1300 Edward I	1578	1661	1772	1819
Proclamation prohibiting use of coal during sessions of Parliament	Q. Elizabeth I annoyed by coal smoke and complains to Parliament	John Evelyn's book: He has described the inconvenience of air and smoke of London dissipted with suggestions for remedies.	2nd edition of Evelyn's book	1st English Select Committee.
1843	1845	1866	1875	1905-11
2nd Select Committee	Parliament passes law requiring locomotives to consume own smoke	1st paper on effects on health due to air pollution	Cattle deaths at London shown due to air pollution episode.	Dr. Des-Voeux uses term 'somke-fog' deaths, i.e. smog.
1919	1930	1948	1952	1955
1st paper on a auto-air pollution (co effect)	Meuse Valley, Belgium, disaster.	Donora, Pa., disaster.	London disaster	1st U.S. Federal Legisatalion
1956	1963	1966	1970	1975
British Clean Air Act.	U.S. Clean air Act	East coast Thanks giving episode	U.S. Amended Clean Air Act.	U.S. Primary standard to be reached.

Source: Parkins H.C(1974) *Air Pollution*,McGraw Hill Kogakusha Ltd.,Tokeyo,p.7

extensive use of coal as fuel. This disaster was held responsible for 4,000 deaths. New York also has had such episodes of air pollution caused by excessive use of coal and oil which have been responsible for 168 deaths in November 1953 and in November 1962.

The quantification of social costs is very much difficult because of lack of : (1) appropriate information detailing quantitatively the emission of pollutants in the environment, (2) accurate assesment of the pollutants on the ecosystem in terms of dose (or concentration level) - damage relationships. Inspite of that, attempts have been made very recently by Shelby and Judd et. al. to quantify social costs. Both studies used a value for human life of $ 3,00,000 based on daily wage of $50 and 6,000 days of production life. Although the study of Shelby contains a wealth of information on social costs it stopped short of quantifying all such costs in terms of money on the gorund that, the costs as we know them now, do not form a complete set and are not mutually exclusive. Judd et. al., however, quantify the social costs in terms of money through the application of probability theory and sensitivity analysis. Their conclusion is that SO_2 removal is the most expensive in the abatement programmes, 10 times of all other abatement costs. Inhaber in 1978 has published a thorough analysis of the comparison of the risks which are associated with both the conventional and the non-conventional resources. This analysis includes occupational and public health hazards which are associated with the fuel consumption. In this study he mentioned that the combustion of coal constitutes the highest risk and it is equivalent to the loss of 3,000 man days per MW year. Next to coal, oil carries the maximum risk. Natural gas is the lowest risk bearing fuel which creates the risk equivalent to the loss of 6 man-days per MW year. The position of nuclear energy in this regard is in between the position of coal and oil and natural gas. It is responsible for introducing the risk of about 10 man-days per MW year. Inexhaustable sources like power, solar space heating, solar thermal electricity generator etc. usually generate the risk the extent of which is in between the natural gas and nuclear energy at one end and coal and oil at the other extreme. In this case, risk responsibility ranges equivalent to the loss of 30-1000 man-days per MW year. On an average all these energy sources carry average social costs of about 881 man-days per MW year. One can have a similar picture from the report of U.K. Health Safety Commission (1978). Instead of quantifying the social cost (because of lack of appropriate data) Eden et.al. in 1982 prepared a table where they presented a qualitative indication of the type of hazards emerging from the combustion of fuels in course of their normal operation. In this study also, they have got the same ranks for coal, oil, gas and nuclear energy as have noted above. Table-4 shows the types of

hazards arising from normal operation. To emphasize the judgemental nature of the table, social costs have been ranked as low (L), medium (M) and high (H) rahter than being given values in quantitative terms.

Table- 4: Types of Hazards Arising from Normal Operation

	Oil	Gas	Coal	Nuclear	Energy
Injury to workerss	M	M	M	L	
Health risk					
- Worker	L	L	H	M	
- Public	M	L	H	L	
Ecological Impact	M	L	M	L	
Climatic change	M	M	M	L	
Amenity impadt	M	L	M	L	

Source : Eden,et al.(1982) *Energy Economics-Growth, Resource and Politics*, Cambridge University Press. p.235.

Industries are responsible for not only air pollution but also for water pollution. Rapid promotion of industrial activities during the last part of the present century has brought about a serious water shortage in many areas.The clean water for any kind of work is a scarce resource. The supply of water over the years is somehow constant for the world as a whole. In some regions the quantity of water needed by the industries and muncipal uses may exceed the available supplies. In this case, the same water has to be used several times and to convert the used water into that of usuable quality it involves costly purification treatment each time. Again, if the demand for the use of water increases rapidly, the entire civillisatiion will very soon face the situation having no balance between the demand for and the supply of water. As a rsult, the future generations will have to spend a substantial proportion of their total efforts to make the water resources usable. The present efforts towards desalination of ocean water may well foreshadow the shape of things to come. Although, if it is possible to reduce the cost of desalination per gallon of water, the amount of water required will involve rise in total costs to such a scale which will considerably increase the overall costs of living.

Industrial activities, especially in textile goods production, food processing, tanneries, chemicals and phermaceuticals generate a wide variety of waste products that are discharged directly into the water courses. Many industrial wastes are organic compounds that can be degraded by bacteria and cause unpleasent odour and contaminate water courases like canals carrying waste water for considerable distances. Sugar Industry is an appropriate example in this respect. The heaping of waste products emitting bad smell causes inconvenience to the people of the neighbouring places. Like air pollution, the increasing incidence of water pollution in many industrial localities can be understood from the vicious-circle effects of various large scale industries in a particular locality, the emergence of new technology in the form of new production processes, the expansion of population and their settlement in these localities and the emergence of new transport system etc. Among 600 units of manufacturing establishments in Kanpur city of India, most of the industrial units use significant amounts of water and thus produce

liquid waste materials which are thrown out directly into the nearby water ways. (I.I.T. Kanpur, 1987). In America, 80% of industrial establishments are connected with municipal sewage system and it is estimated that about 33% of the organic wastes treated by municipalities are industrial in origan (Pollution Abatement Committee. USA. 1960). The remaining plants which use to discharge their liquid wastes directly into various water courses are felt to be 'far more important both in terms of total volume of strength than are the wastes from those industries discharging through municipal sewage system' (Pollution Abatement committee. 1960). It has been estimated that industrial waste water discharged through the total amount of water that industry uses only 2% leaves the premises as a part of the product (Chanlet,' 1972). Considering 2% loss by evaporation, there remains a huge amount of waste water which the industries are discharging daily. Industries like tanneries and textiles use 300-400 gallons of water per lbs. of hide processed and 3000-9000 gallons /1000 yeards of cloth manufacturing repectively. After the end of all processing works, these industries throw back a huge volume of water and waste substances into the traditional sources of water like rivers. All of these are of course rough estimates, but on the basis of these estimates one can at least set a stage for further discussion of the problems of water pollution.

Some industrial pollutants like chemicals, minerals, petrochemical effluents and radio-active materials are not changed considerably by the existing treatment. In addition to this, some polluting materials of large scale industries carry infection and disease carrying organisms. The objectionable components of industrial waste water are shown in Table-5.

The adverse effects of some primary toxicants like Arsenic (Ar.), Cyamid (Ch), Cupper (Cu), Iron (Fe), Cromium (Cr.), Mercury, Metals, Leads, Acid, etc. disrupt P^H buffer system in the normal water. These are sufficient to kill the micro-organisms and change the characteristics of normal water, that is it can change the taste, odour, colour, hardness and salinity concentration of water. Such polluted water may cause the destruction of fish and other living beings or it can reduce the destruction of fish and other living beings or it can reduce the production of fish by imposing harmful effects on their normal life. Such polluted water can also cause the health hazards for its users.

Table-5: Objectionable Components of Industrial Waste Water ,Their Effects and Typical Sources.

Component group	Effects	Typical Sources
1. Bio-oxidizable expressed as BOD.	Deoxygenation, anaerobic conditons, fish kills. stinks.	Lare amount of soluble carbohydrates, gugar refining conning. distillaries,tanneries. milk processing, pulping and paper making, breweries and textile mills.
2. Primary toxicants As, CN, cr,cd,cu,Fe,Hg, Lead,Zinc	Fish die, cattle poisoning plankton dies accumulation in flesh of fish and human being.	Metal cleaning, plating, pickling and refining. chlorine generation, bettery making, tanning, taxtiles etc.
3. Acid and Alkalines	Disruption of pH. buffer system, disordering previous ecological system	Coal-mines, drainage, steel pickling, textiles, chemical manufacturing. wool scouring, launderies.
4. Disinfactants: chlorine hydrogen peroxide (H_2O_2), formalin, phenol.	Selective kills of micro-organisms, taste and odour	Bleaching of papers, textiles, penicillin operations, gas, coke dyes and chemical manufacturing plants.
5. Ionic forms: Fe,Ca, Mg, Cl, So_4	Change water characteristics: staining, hardness, salinity concentrations.	Metallurgy, cement making, ceramics, pumping, metal industries.
6. Oxidizing and reducing agent such as NH_3, NO_2, NO_3, SO_3	Alter chemical balances ranging from rapaid oxygen depletion to our nutrition, odour, selective microbell growth.	Gas and coke making, Fertilizer plants. explosive manufacturing, dyeing, synthetic fibre wood pulping and bleaching.

Source: Kumra, V.K. (1982) *Kanpur city -A study in Environmental Pollution*; Tara Book Agency, Varanssi.

** Water has two characteristics, one is acidic and the other is basic. P^H buffer system balances the level of acid and base in the water. When p^H is 14, water shows fully basic character and when it is O, water shows fully acidic character. In normal water p^H is 7.*

Therefore, it is certain that the pollution of rivers, streams, lakes or any other water courses is a typically cumulative process with wide spread insidious effects extending over a great range of industrial activities. It is also equally certain that both the number and the volume of pollutants are increaseing and the technological advancement will make the problem of water pollution like air pollution, one of the major social cost of modern industrial civilization.

It is not essy to estimate the social costs of water pollution. It may be possible to estimate the market values of increasing repair and maintenance costs of a particular structure which is damaged prematurely by the chemical discharge of any industry. It may also be possible to calculate the market values of the loss of livestock. the destruction of crops. loss of soil fertility or even some uncertain recreational facilities. For advanced countries. data in this regard may be available. but in the case of LDCs. these are not so. In addition to this. the available data relating to the advanced countries in this respect are far from reliablity. and also incomplete and misleading. In America. it has been estimated that the cost of waste treatment in the manufacturing of paper amounted to about 15% of the annual value of the total output in 1935. In case of textiles such costs would reach about 20% of the total value of output (Wilson and Jones. 1974). In addition to this. there are many things which cannot be valued in terms of money. For instance. the inconvenience of a person due to the bad smell of contaminated water passing by the side of his residence or the inconvenience that a man faces due to the change of colour and taste of water does not admit of a precise monetary valuation. The threat of imbalance between the supply of and the rapid increases in the demand for water (specially by the rapid growth of industrial activities) all over the world cannot be valued in terms of money. Rapid promotion of different industrial activities creates a new physical environment for men which is considerably different from that in which man has been living for centuris together and the implications of this man-made environment on the living beings. for their survival are far form being fully understood. The threatening imbalances between the constant supply of and the rapidly increasing demand for clean water open up another perspective of social costs of water pollution. Agriculture as well as industrial growth depends upon the adequate and systematic supply of clean water. Therefore. the areas which are not able to protect their water courses (supply of which is practically limited) from various types of pollution will face the problem which could destroy one of the very important productive factors. i.e. water. upon which their present and future prospertity depends. Hence. like air pollution. the pollution of water is essentially a social cost which needs to be fully assessed.

Noise pollution is another aspect of social costs. Noise level inside the industry is very much important, because a large number of labourer are engaged in factories where machines operate day and night. Textile industries are suitable examples in this respect. In most of the textile mills the noise levels are above the threshold of danger level with potential to cause permanent hearing loss. In India. about 8,00,000 workers engaged in textile mills and working in weaving and spining sections are worst affected. The noise level in a big textile mill like Lalimli (India), weaving section is in the range of 100-105 decibels and spinning and preparatory departments between 80-90 decibels. Noise pollution is not a problem only in the textile mills but also in all the factories where heavy machines operate. Noise of high level affects the heart as well as decreases oxygen supply to the brain. It has been observed that it is not possible for a person not working in the factory to stay more than one hour in any machine section. A study of the I.I.T.

Kanpur of India reveals that factory's noise level in general is more than the tolerance limit. Noise pollution is such a cost item which does not have any traditional market for its valuation like consumers goods. Several studies have been conducted which examined the effect of noise on property values and appartment rents. Kumra (1982) in his research work found that noise partially determines the prices of residential accomodation. A noisy house has less value than a quiet and peaceful one and the difference between this two is about 20% in Kanpur city.

Modern industries tends to concentrate in metropolitan cities, because it is easier to set up new enterprises where there are already more industries. This tendency is noticeable all over the world. In Bangladesh, there is a tendency for Dhaka, Chittagong and Khulna cities to attract all industries. In India, industrialisation is concentrated mainly in the cities like Delhi, Bombay, Calcutta, Madras, Kanpur etc. The modern industries of the urban areas are tending to terminate all the non-farm production in the rural economy by enjoying the advantage of escaping the social costs they involve directly and thus bring forth the rural unemployed and their ultimate flight into the urban areas. This migration of the rural people gives birth to slums and other related evils like the unhealthy environment due to the shortage of proper sanitation facilites for the slum dwellers. The social evils like theft, prostitution, blackmarketing, etc also increase in the urban areas due to the shortage of means for the slum dewllers to their basic needs. Often it has been heard that Calcutta is one of the dirtiest cities of the world. Why Calcutta is so dirty ? The answere is, it is highly unorganised which has no similarity with the surrounding rural areas and the advanced industries of this city already kill off a significant portion of rural non-farm activities and invite mass migration. Calcutta city is now containing a population of about 9.6 million (India-A Statistical outline, 1986). The result is that the city is infested by slums, surrounded by misery-belts that are growing fast beyond imagination. Considering all these, it can be concluded that, modern large scale industries involve enormous social costs which cannot be over looked.

Conclusion

In the foregoing discussion, it has been stated that the modern large scale industries entail disproportionately high social costs in relation to the benefits bestowed by them on the society. The evils of air, water, noise and social pollution caused by the large scale industries have been very well recognised and identified today in the wake of the widespread concern for the protection of environment. The abatement cost of pollouted air and water should be included in the total cost of industries responsible for such pollution. The industries escaping the social costs in their cost calculations (which cannot be measured in terms of money) are needed to be identified and taxed so as to bring the prices of their products in conformity with the costs.

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Socio-Economic Condition and Post-Harvest Rice Loss of Farmers in Bangladesh

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Abstract

The average household in a village was 101.1 containing six members of which 53.6% were adult. About 57% of the farmers owned 1 ha or less land while 29% were landless. Local varieties were grown to 52% of the total land area and the rest (46%) were occupied by high yielding varieties (HYVs). Cropping intensity decreased with increased in farm size averaging 165%. Although the area devoted to 'Boro' was less, crop production was higher by 10.4% than 'Aus' season but lower by 12% than 'Aman'. The percentage of HYVs production was also high compared to local varieties. The smaller percentage of paddy sold (23%), indicated the need of food grain by the farmers for consumption. Even if a large percentage of the grain produced was retained, only 55% of the farmers self-sufficient in rice. The average post-harvest losses observed were 13, 13 and 13.7% for 'Aman', 'Boro' and 'Aus' seasons respectively. A detail survey reflected that post harvest rice loss was greatly influenced by socio-economic conditions of the farmers.

Introduction

With the existing socio-economic condition of the people and the varying weather elements (storm, rain, draught, flood, high and low temperatures between localities) a system of agriculture distinct to the area has developed. About 11.5 million hectares of the country's cultivable land area is devoted to rice, the staple food of the country (BBS, 1984b). The annual grain production is not sufficient to supply the consumption demand of about 110 million population growing at the rate of 2.32% (Rabbani, 1984), compelling the government to import about 1.5 million metric tons of food grains every year (Jabber, 1982). Almost 85% of the population live in the rural areas with agriculture providing employment opportunities to 61.3% of the farm labour force (BBS, 1984b). With high farm population density and low literacy, small farm size, large family, low cropping

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intensity and production, farmers very much dependent on traditional farming methods. The land topography, agro-climatic and socio-economic conditions are the factors that lead to subsistence farming and dependence on traditional methods and equipment, adversely affecting crop productivity and economic well-being of the farmers.

A method of increasing rice production is the reduction of post-harvest losses which like the other aspects of agricultural production, is also affected by the socio-economic condition of the farmers, agro-climatic and topographical characteristics of the area. Traditional labour-intensive post-harvest practices are followed by the farmers in the country. Although there is a perceptible change in some of the post-harvest operations from traditional to improved method (as the use of huller mills in the villages and the use of pedal threshers in places where HYVs are grown), there is a certain degree of resistance to change because of the inherent socio-economic factors. Therefore, study on the socio-economic status is important to gather information on the causes and reasons of losses incurred, and in instituting loss prevention programmes to increase food availability in the country.

Samajpati and Sheikh (1981, pp.39-42.65) reported that all post-harvest operations in Bangladesh like harvesting, threshing, parboiling, drying and storage are very primitive and time consuming and the possibility of grain loss is high due to various causes. Therefore, to quantify post-harvest rice loss in various operations, a study was conducted jointly by Food and Agriculture Organization (FAO) and Bangladesh Rice Research Institute (BRRI).

Haque et.al. (1989, pp.59-63) reported that the estimated total rice loss in harvesting (including pre-harvest loss), field stacking/bundling/drying and transporting (from the field to the threshing floor) varied between 2.4 to 3.9% (with a weighted average of 3.5%) depending on the crop season. In addition, a total of 3.5% weighted average loss (varied between 3.1 to 4.0%) was estimated in threshing, cleaning/winnowing and sundering (Haque et al., 1991). However, majority of the loss (~8.0%) incurred during parboiling (soaking, steaming and drying) and milling (Quasem et al., 1985). They also documented a negligible loss (0.6%) during storage. This result was based on a survey of different types of storage structures at farmers house and after laboratory analysis of the infested samples by insects.

This study was made, therefore, to establish the relationship between the socio-economic factors and post-harvest loss in rice, and make recommendations to reduce loss and improve socio-economic conditions of the farmers.

Materials And Methods

Five districts (Dhaka, Sylhet, Comilla, Bogra and Rajshahi) were selected based on production, weather condition, accessibility, cropping patterns and production surplus. Thirty five villages were studied based on accessibility, farmers co-operation, representativeness of the post-harvest practices and cropping patterns of the districts. Loss assessment studies were conducted during 1983 'Aman' and 1984 'Boro' and 'Aus' harvest seasons. The detail procedure and loss calculations were measured following the rice loss assessment manual" prepared by Arboleda et al. (1984).

A village survey was conducted before starting the field loss assessment study to explain the objectives and for the field staff to familiarize themselves with the cropping patterns, post-harvest practices and more generally the socio-economic and agro-climatic conditions of the villages. A socio-economic survey questionnaire containing the farmers identification, family size, land interest and cropping patterns was formulated, tested and finalized (Greeley, 1983). This questionnaire was used in a door to door survey conducted to all the farmers households once in each village.

The methods used in calculating rice self-sufficiency are shown below:

1. Equivalent adult number in a household[a] = (No. of adult male x 1) + (No. of adult female + No. of 10 - 14 years old) x 0.83)) + (No. of 5-9 years old x 0.7) + (No.of 1-4 years old x 0.5)
2. Equivalent rice production, if land is owned = Total production x 1.00
3. Equivalent rice production, if land is leased -in = Total production x 0.50
4. Equivalent rice production, if land is leased-out = Total production x 0.50
5. Total rice available = (2+3+4) x 0.9[b] -Total quantity paddy sold
6. Rice sufficiency status = $\frac{\text{Total rice available (5)}}{\text{Equivalent adult number in household (1)} \times 7.6^{c}}$

[a] Assumed equivalent adult consumption: Adult male = 1; Adult female and 10-14 years old = 0.83; 5-9 years old = 0.70; 1-4 years old = 0.50

[b] The value 0.9 is assumed ec ring 0.1 as the value used for seeds and other farm sharing practices by the famers.

[c] Equivalent adult annual consumption of paddy in maunds (1 maund = 37.324kg)

SELF SUFFICIENT FARMERS = When rice sufficiency value obtained is equal to or greater than 1

$$7.\ \text{Rice Self-Sufficiency, \%} = \frac{\text{Total rice self-sufficient farmers}}{\text{Total farmers}} \times 100$$

Results And Discussions:

Population Distribution

The average population of the villages surveyed was 607 and the average family member was 06 with adults constituting about 53.6% (Table-1). The percentage of 10 to 14 years old was lower than the other age brackets because they were born just before and after liberation when the country was recuperating from the war of independence in 1971. Although adult population was considered from 15 years and above. 10 to 14 years old male members are already utilized by the farmers to do major farm operations.

Tenurial Status

Farmers who were really working in the field, i.e., owner-operators, owner-cum-share-croppers, part-owner-operators and pure tenants constituted 66.6% of the farmers population (Table 1). BBS (1985) reported that in 1977 these four tenurial classes constituted 62.3% of the farmers. The landless labourers (25.7%) with no land being cultivated and the pure tenants (3.5%) who do not own land but were share-croppers constituted the landless farmers mentioned above. Absentee farmers who owned land but were rented or mortgaged out and engaged in off-farm occupations were 7.7% of the farm population. This has found no relationship with post-harvest rice loss.

Farm Size Distribution

Majority of the farmers surveyed (56.8%) were categorized as 'small farm' because they owned 1 ha or less land (Table 2). Percent increased of this group has decreased post-harvest rice loss. This implies that small farmers are more efficient than all other groups in post-harvest farm practices.

About one third (29.2%) of sample farmers were 'landless' as they were not owning any land. 'Large farm' ownership with more than 3 ha of land constituted a very small percentage (1.7%) of the farmers. The relative contribution of farmers with small, medium and large farm lands were 50.7, 34.5 and 10.4% respectively, of the total paddy produced. The increased contribution to total paddy production by small farmers over medium and large farms was the result of higher cropping intensity and lesser post-harvest paddy loss which implies that the increased

production can be achieved by increasing cropping intensity. To implement these, necessary production inputs as fertilizers, seeds, insecticides, technical assistance, irrigation and other incentives as government price support programmes for rice must be made available to the farmers.

Cropping Intensity

The cropping intensity in all the study areas decreased with increased in farm size. Cropping intensities of 177.7, 158.8 and 141.7% were observed for small, medium and large farmers, respectively, with an overall average of 164.9% (Table-). Bangladesh Bureau of Statistics (1985) reported that the 1981-82 average cropping intensity of the country was 153.9%. In showing the relationship between cropping intensity, farm size and post-harvest paddy loss, it could be explained that paddy loss has direct relationship with farm size and inverse relationship with cropping intensity.

Self-Sufficiency Status

More than half (54.8%) of the farmers surveyed were self-sufficient in rice (Table 2). Rice self-sufficiency status of the farmers increased with the size of farm holdings. About 46.7% of the small farmers and majority of the medium (85.5%) and large farmers (91.9%) were self-sufficient in rice and the loss increased with the increase of self-sufficiency status in rice.

Moreover, it is emphasized that if the farmers produce other serial grains or root crops and use this as substitute to rice as staple food, food self-sufficiency status of the farmers would increase. Therefore, an alternative way of increasing food self-sufficiency is to encourage farmers to plant and produce other food crops as a substitute to rice. Self-sufficiency also be enhanced by increasing productivity and population control.

Total Cropped Area for Modern Variety

One of the salient feature of modern variety (MV) rice is non-shattering. They were developed for providing high yield as well as reducing grain loss. The present study showed that less loss was incurred under MV rice cultivation (Table 3). Thus, expanding more and more areas under MV rice cultivation could reduce post-harvest rice loss.

Land Utilization Pattern

Farm lands were utilized more in the 'Aman' (49.7%) compared with the 'Aus' (28.8%) and 'Boro' (21.5%) seasons (Table-3). This is due to the topographic and agro-climatic conditions of the country. 'Boro' season is characterized by dry cool weather and lack of irrigation facilities. A large portion of irrigated land is also

used by farmers in planting dry season 'Rabi' crop. Low lying areas are flooded during 'Aus' season. A large area of land cannot be utilized for planting rice during these two seasons. Bangladesh Bureau of Statistics (1985) reported that about 56.6% of the cultivated area in the country during 1982-83 was devoted to 'Aman' season.

The local varieties (transplant and broadcast) constituted a large portion (54.2%) of the rice cropped area compared with HYVs (45.8%) in the three seasons studied. According to Torrent (1982, pp.103 -113), the increase in rice production with the area planted to HYV is not sufficient to supplement the additional production target requirement of two million tons per year to achieve food self-sufficiency. However, if HYVs are grown in place of the local varieties, the increased production will help in meeting the rice self-sufficiency in the country.

Production Pattern

Table 3 indicates that the paddy contribution of the 1983 'Aman' (44.8%) was higher than the 1984 'Boro' (32.8%) and 'Aus' (22.4%) seasons. Production distribution for 1983 'Aman' 1984 'Boro' and 'Aus' seasons were 56.5, 23.8 and 19.8% cleaned rice, respectively (BBS, 1984a). High production in the 'Aman' season was mainly due to the large rice cropped area.

Sale of Produced Rice

The percentage of paddy sold by the farmers in all the areas studied were 7.3, 11.4 and 4.3% for the 1983 'Aman' 1984 'Boro' and 'Aus' seasons, respectively or a total of 23.0% (Table-3).The high percentage of grain sold during 'Boro' season could be due to the inability of the farmers to process the grain properly because of rainy weather, short time interval between 'Boro' and 'Aus' seasons' harvest, and the lesser degree of preference by the farmers to the HYVs generally produced during 'Boro' season. The farmers sold less of the 'Aman' produced, although the percentage of production was higher than the other two seasons, because the grain were processed and dried well for longer and safe storage. Also, 'Aman' rice harvest is preferred and sells at higher price after storage for some time.

The consumption preference of farmers to HYVs seemed to be low because a large portion of the total paddy sold (16.1%). This consumption preference explains the insistence of the farmers to plant local varieties even if the yields were low.

Post-Harvest Rice Loss

Results of the rice loss assessment study of different post-harvest operations (harvesting, field stacking/bundling/drying, field transport, threshing, cleaning/winnowing, drying, parboiling, storage and milling) of the 1983 'Aman' and 1984 'Boro' and 'Aus' seasons were 1.04, 13.02 and 13.72% respectively

(Table-3). The values indicated were quantitative loss only. The variation in the loss values obtained between the small, medium, and large farmers were small. This result indicated that the care given by the farmers in minimizing loss in all the different post-harvest operations were about the same.

Considering total production in different areas where these studies were conducted, the equivalent loss is about 814.4 tons or Tk. 3869521 (US$ 143315.6 ; US$ = Tk. 27.00) at harvest selling price of paddy indicated in the table. If the loss estimate was projected to the BBS (1984a) estimate for the same seasons studied on the country's production, the equivalent loss was Tk. 13508 million or US$ 500.3 million.

Conclusion and Recommendations

Post harvest loss is largely affected by socio-economic condition of the farmers. Therefore, the socio-economic condition must be taken into consideration in introducing any innovations, change or improvement in farm practices.

Government and public sector should extend full support in providing the necessary agricultural inputs (seeds, fertilizers, irrigation facilities etc.) and widespread information drive through training and demonstration for the farmers to adopt improved rice production methods not only to increase production and self-sufficiency but also reduce post-harvest loss in rice.

Table-1: Population Distribution, Tenurial Status and Other Statistics of the Villages Surveyed

Population Distribution	%	Tenurial Status	%	Other Statistics Per Village	%
Adult male	27.4	Owner operator	32.9	Population (No.)	607.0
Adult female	26.7	Owner-cum-share-cropper	19.1	Household (No.)	101.1
10-14 years	12.1	Part-owner operator	11.1	Av. number of family members	6
5-9 years	17.5	Pur tenant	3.5	Farm acrs (ha)	68.2
1-4 years	13.7	Absentee	7.7	Production (ton)	176.7
Below 1 year	3.0	Landless labour	25.7	Literacy (%)	21.7

Table- 2: Percent Distribution of Socio-economic Factors (in %) by Farm Size

Socio economic factor	Small Farm[a]	Medium Farm[b]	Large Farm[c]	All Farm
Distribution of farmers	56.8	12.3	1.7	-
Cropping intensity	177.7	158.8	141.2	164.9
Production	50.8	34.5	10.4	95.7
Self-sufficiency	46.7	85.5	91.1	54.8
Paddy loss	12.8	13.0	14.1	13.3

a. Small farm owns 0.01-1.00 ha of land
b. Medium farm owns 1.01 - 3.00 ha of land
c. Large farm owns 3.01 ha and above.

Table-3: Rice Cultivation Statistics in the Study Areas by Season and Variety

Rice Cultivation Statistics	Season			Variety[a]		
	Aman	Boro	Aus	MV	LV(DS)	LV(IP)
Area Cultivated (%)	49.1	21.5	28.8	45.8	26.5	27.7
Production (%)	44.8	32.8	22.4	66.4	13.2	20.4
Production(ton)	2770.0	2028.0	1390.0	4126.0	816.0	1261.0
Loss (%)	13.1	13.0	13.7	2.0	5.6	4.1
Loss (ton)	362.9	263.6	190.4	-	-	-
Loss (Million Tk.)[b]	17.4	13.2	8.2	-	-	-
Sale (%)	7.3	11.4	4.3	16.1	6.9	-

a. Variety wise loss figures included harvesting to field transport loss. MV = Modern variety; LV (DS) = Direct seeded local variety; LV(TP) = Transplanted local variety.

b. Based on the average price at Tk. 4.80, 5.00 and Tk. 4.30 per kg for 1983 Aman, 1984 Boro and Aus seasons respectively.

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