ECOLOGICAL AND ECONOMICAL ASSESSMENT OF PADDY (*ORYZA SATIVA*) CULTIVATION IN SOME VILLAGES OF SHAHUWADI TAHSIL OF KOLHAPUR DISTRICT OF MAHARASHTRA, INDIA

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ABSTRACT

Kolhapur district is abutting Western Ghats present in Maharashtra state. Western ghat is ecologically important area of our country. This area is supporting good agronomical conditions and similarly it has stress due to extensive agriculture. Traditional methods of agriculture still persist in these regions. Input cost and output profit study of any crop is important in agriculture. Less profitable practices trigger unsatisfaction in farmer which is main cause of suicide committed by farmers in our country. ‘Raab’ is one of the traditional agriculture practices for Rice and Millet cultivation. Study of economic efficiency and ecological impact of this practice is carried in some villages of Shahuwadi Tahsil of Kolhapur district. In this practice ecologically valuable trees are cut partially or fully and used for burning to prepare land for cultivation. Some of the tree species used for cutting are economically valuable. Farmers in this area use slash and burn method along with this land burning method for growing paddy and millet since long back. However, the question is arising whether this practice of cultivation is sustainable and the cropping pattern has any cost and benefit consideration. Farmers have different economic perceptions and less ecological concern about this method. This study evaluates aspects of economic cost, profitability and ecological sustainability of this cultivation method.

KEYWORDS: Western Ghats, ‘Raab’, Economic Cost, Profitability, Ecological, Sustainability

INTRODUCTION

A systematic approach in determining the optimum use of resources is becoming important today. India is ecologically bestowed with Western Ghats region which is undergoing degradation due to intensive economic activities by different groups of society. Ever increasing needs of the humanity are making ecological and economical disparities. Loss of lives of farmers by suicide due to economic loss is rising in recent years. Agriculture is important link between man and nature that determines nature of both development and environment by mutual interaction. Economic feasibility studies are of immense importance to improve economy of farmers. Economic analysis involves study of resources and other input commodities that are employed and attempts to measure monetary terms. Farming system employed is important in analyzing the problems of the agriculture. This involves cost-benefit analysis of any activity or a system. Studies have revealed that changing agro-climatic conditions are threatening ecological condition of the Western ghat which is ecologically important region. Large scale conversion of hilly areas in to cultivable land began with rise in population. ‘Raab’ is a typical traditional agricultural practice of farmers for preparation of rice plantlets in Western ghat. In this method trees are cut and used to burn on the land to get it heated before sowing for rice crop.

Kolhapur district is situated in the South-West of the Maharashtra state and is on the fringe of the Western Ghats. WG, Coastal areas, NE and Himalayan region are ecological and economical important areas and impact of agriculture on climate in these areas is to be studied (Kumar, 2010). Rice (*Oryza sativa* L.) occupies first place not only among cereals, but also among all the crops grown in the Konkan region. It is grown mainly on high lying or upland soils and on low lying
lands (Nirban, 2006). Intensive agricultural and industrial practices are posing threat to this area. Degradation of this ghat region is not affordable to us as it has been home for large number of denizens and factor influencing rainfall of our country. Raab agriculture has contributed loss of vegetation in major forest and adjoining areas. Farmers have different perception about this method. There is need to study cost benefit analysis of the present cultivation method.

There are 12 tahsils in Kolhapur district varying in geographical conditions and agricultural patterns. Variable climate of the district supports rich biodiversity. Hence, the district is of great importance ecologically. As there is good rainfall, many rivers flowing through district give highly fertile soil. Therefore, agriculture is main profession in the whole district. Rice (Oryza sativa) cropping has a long history in ghat regions. Kolhapur district has background of farming of kharip and Rabi crops. Study area is at North-West side of the district from where hills of ghat region start to appear. Major crops in the East part of the district are Sugarcane, Soya bean and Groundnut. In this region there is also land under vegetable cultivation due to ample amount of water for irrigation. In the Shahuwadi talsil, there are total 133 villages with population 1, 76,859 (Census Report, 2001). Majority of farming community in this region is of peasant farmers or landholders with divided farmlands. So it is difficult to use mechanized agriculture practices for weeding and other activities for land preparation before sowing.

Keeping these aspects in view, the presents study has been undertaken to investigate cost and benefits of Raab agriculture method in terms of both economic and ecologic gains and losses. Study throws light on the problems associated with farming systems and enables the academicians and policy makers to formulate and implement appropriate policies for a balanced, integrated agricultural development. Farming systems adopted by the farmers are influencing their economy. It is important to adopt methods those are beneficial for economic gain without influencing ecological condition of the area in which these are practiced (Sharma et al 1991) viewed farming systems as a set of agro-economic activities that are inter-related interact among themselves in a particular agrarian setting. They tried to identify farming followed in different agro-climatic zones of Himachal Pradesh. They indicated that vegetable based farming systems are of profitability in the agrarian economy. Sabrani et al., 1985 explained the main aims of Farming System Research are to develop stable cropping pattern, maintenance of soil fertility, efficient utilization of land and labour and the provision of sustained cash income. In the present method of rice cultivation farmers carry out felling and burning of biomass obtained from trees in and around farmlands. They depend upon these trees for construction and for domestic fuel. This situation has enhanced strain on these resources. Ramesh and Konareddy (2003) studied the Agricultural Research prioritization for agro climatic zones of northern Karnataka. He observed that among the socio-economic constraints, fluctuations in prices of output, non-availability of agro chemicals, non-availability of labour during peak season and unawareness of improved technology were the most severe constraints faced by the farmers in the study area. Ranking of constraints based on yield loss indicated that most of the crops across zones were most affected by rainfall, pests, diseases and weeds. Koppad and Khan, (1996) made a comparative economic analysis of two farming systems viz., maize-wheat and maize-sunflower on large farmers in Malaprabha command area. In the present work attempt is made to study economic aspects and ecological consequences of the present farming practice.

MATERIAL AND METHODS

Five villages from Shahuwadi taluka of Kolhapur district were selected for the present study on the basis of area under cultivation of staple crops. Information about acreage of land under agriculture was collected to study the extent of this method. Well structured questionnaire was framed to know the perception of farmers about this method. Periodic and seasonal visits were organized to study the seasonal calendar of various practices. To get past decade population, census data for the period of 1961 to 2001 was reviewed. Discussions were also held with farmers to know their perception about
this practice and also to study their view about modern cultivation methods like nursery plantation. Observations about type of material used were made and their preferences were ascertained with discussions. Discussions were also held with people working in agricultural institutes and NGOs working for eco awareness at the tahsil place. A major portion of information about ‘Raab’ burning was collected in the field during the course of interactions with local field informants and by just observing their activities in the field. All the informal observations regarding this practice were noted keenly.

Information about production costs and income was collected. Besides this, some secondary data have been acquired and used to determine extent of this practice.

Irrigated Rice Cultivation in Western Ghat Region and Study Area

RESULT AND DISCUSSIONS

Total Land under Agriculture

Total cultivated area in all the villages under study from the Shahuwadi tahsil under raab dependent crops is 4976 acre (table-1). Uncultivated area covers land kept without any crop cultivation as fallow farmland or used for other purposes in farmlands. 6% and 36% of total land of villages Parle-Ninai and Bhendawade is under protected forest. Remaining area is under residence, uncultivated and hills. Area under cultivation is getting divided and reduced. It is resulting in patches and encroachment on hills for both lands for cultivation and to get the biomass for burning.

Table 1: Total Agricultural Land in the Villages Taken for the Study from Shahuwadi Taluka, Dist. Kolhapur

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Village</th>
<th>Cultivated Area (Acre)</th>
<th>Uncultivated Area (Acre)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Karungale</td>
<td>556</td>
<td>262</td>
</tr>
<tr>
<td>2.</td>
<td>Altur</td>
<td>1646</td>
<td>444</td>
</tr>
<tr>
<td>3.</td>
<td>Pusarle</td>
<td>1125</td>
<td>258</td>
</tr>
<tr>
<td>4.</td>
<td>Parle Ninai</td>
<td>1177</td>
<td>404</td>
</tr>
<tr>
<td>5.</td>
<td>Bhendawade</td>
<td>472</td>
<td>79</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>4976</strong></td>
<td><strong>1447</strong></td>
<td></td>
</tr>
</tbody>
</table>

(Source - Tahsil Agriculture Department, Shahuwadi)

Material Preferred for Raab and Its Collection by Farmers

Information revealed that farmers are dependent for biomass maximum from nearby forest area. Cattle dung is preferred by only 20% of respondents. This is due to use of cattle dung to prepare fuel material as they don’t have LPG as domestic fuel (figure-1).
Figure 1: Material Used and its Collection Sites

Figure 2: Types of Supplement Used and Percentage of Farmers Dependent upon ‘Raab’ Burning

From the figures 1 and 2 it is clear that maximum people in this region carry out this practice. They use trees and other biomass from forests or area nearby forests and many times trees near roadside (see plate 1). This puts pressure on the forests and other wilder areas in the form of species loss resulting from habitat loss. Their dependence on green manures and composting should be promoted to seize down the further degradation of the vegetation cover of the villages. (see figure 2)

Ecological Impact of the Raab Agriculture Practice

This practice was in limited extent when population was less and biomass was available in ample amount. Today with rising population, farmers are facing problems of scarcity of organic material. It was found that none of farmer carry special plantation to meet the need. Use of dry biomass as fuel has worsened the situation.

Table 2: Population Rise in the Study Area since Year 1961 to 2001

<table>
<thead>
<tr>
<th></th>
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<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Karungale</td>
<td>994</td>
<td>1177</td>
<td>1359</td>
<td>1803</td>
</tr>
<tr>
<td>2</td>
<td>Altur</td>
<td>853</td>
<td>1007</td>
<td>1076</td>
<td>1411</td>
</tr>
<tr>
<td>3</td>
<td>Pusarle</td>
<td>339</td>
<td>555</td>
<td>547</td>
<td>799</td>
</tr>
<tr>
<td>4</td>
<td>Parle Ninai</td>
<td>860</td>
<td>1082</td>
<td>1211</td>
<td>1762</td>
</tr>
<tr>
<td>5</td>
<td>Bhendawade</td>
<td>351</td>
<td>413</td>
<td>458</td>
<td>559</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td>3397</td>
<td>4234</td>
<td>4651</td>
<td>6334</td>
</tr>
</tbody>
</table>

(Source- Census of Kolhapur District, 1961 to 2001)

Table 3: Population Rise in the Villages since Last Four Decades

<table>
<thead>
<tr>
<th></th>
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</thead>
<tbody>
<tr>
<td>Percent rise</td>
<td>80.23%</td>
<td>91.03%</td>
<td>73.42%</td>
</tr>
</tbody>
</table>
Ecological and Economical Assessment of Paddy (*Oryza sativa*) Cultivation in Some Villages of Shahuwadi Tahsil of Kolhapur District of Maharashtra, India

According to old aged respondents in villages this is attributed to the fact that areas with natural vegetation were encroached by villagers for settlements and agricultural land. There is considerable rise in population of the villages obviously in the entire tahsil (table-3). By the beginning of the 1970s, less educated rural labour also started moving to other places in search of work towards proximity to urban centers. Migration of rural labour reduced the supply of agricultural labour in the village further and pushed up farm wages.

Average rate of population growth per decade is 61.17%. This fact has implication with intensified agricultural activities of this kind. Due to natural regeneration of tree species which is time required to regenerate one tree species once felled is reducing. So there is possibility of drying and dying of the many well grown trees (see plate 1).

**Commonly Used Tree Species for Biomass**

Tree species used for biomass collection are common in all the villages. Trees of Jackfruit (*Artocarpus species*), Tik (*Tectona grandis*), Hirda (*Terminalia chebula*) gives good ash after burning. Hence, these trees are used by more number of people. They search for these in village lanes, on hills around the villages and along the roads. If these are not available then they move to undeclared forests or area near declared forest.

Eucalyptus and Acacia are commercially important and also give coal after burning which does not get mixed in to the soil and hence not preferred by farmers. Some of the tree species are commonly used trees are seen most vulnerable to frequent lopping. Some of these trees form good canopy over the land thereby reducing loss of soil moisture which avoids lowering of water table. Trees of Kinjal species is preferred by most of the farmers which is one of the common species of forests in this area. This tree is seen prone to cut and shows stunted growth. Conservation of these tree species is important as many endemic birds are found building their nests on these trees.

**Intesity of Practice and Its Impact on Surrounding**

According to maximum old aged respondents in all the villages previously in their time of agriculture, material required to prepare biomass for burning was available in ample amount. Now a days people are getting scarcity of the same. So farmers make the use of government planted trees to get the biomass (plate 2). As burning is carried in masses during core season of activities pollution due to smoke can clearly visualized at evening when winds are calm. This is common scenario in the months of March and April in ghat region (plate 3). With the clearing of land under miscellaneous trees, green manure became scarce. The supply of farmyard manure declined with the decrease in the cattle population. Forests and woods had been the main source of supply of green manure for paddy fields and fodder for cattle. They also were a source of supply of firewood to the rural poor. Destruction of forests cut this major source away. Cultivators had then to depend more on external sources of supply and as a result cost of cultivation goes up. Increase in the cost of cultivation is said to be one of the reasons for the shift from paddy to other crops.
Plate 3- Pollution of Atmosphere Due to Biomass Burning

WWF-India hypothesizes that an improved practice of raab will reduce the vulnerability of the forests. It has been planned by WWF-India in seven villages located in the fringes of the Purna wildlife sanctuary. The study included cultivation of finger millet and rice without burning of biomass and promotion of organic farming.

Farmers carry out felling and burning of biomass obtained from trees in and around their farmlands. People residing in study area use timber for construction and also they depend upon wood for fuel. Consequent on the increased demand for land for housing purposes, even sacred groves and woods have been destroyed. They were once the lungs of the village and were the habitat of a variety of flora and fauna. Further these places were the storehouse of a variety of medicinal plants and herbs. Near these woods small water holes and streams were perennial sources of supply of water to the nearby residents. With the elimination of the sacred groves and woods all the have been lost forever. This indicates loss of natural resources even this method is turning unaffordable.

Economics of Paddy Cultivation with Raab Preparation (Land Burning)

Each year farmers prepare rice plantlet for replanting on farmlands by marsh method. This type of rice plantation is customary in ghat and Konkan region. Taking in to account expenses from land preparation up to harvesting of grain this method proves to be unaffordable to farmers. Cutting of the branches and carrying it to farmland is a labour intensive work which adds capital cost of the present agriculture method reducing net income (see plate 4 and 5)

Input Cost for Rice Cultivation by Raab Burning Method

Rates for Agricultural Labour in Villages

A man working on farm gets Rs. 100 and a woman gets Rs 70 per day. It takes one week for collection, carrying of biomass, burning on land and mixing in to soil. For cultivation of rice on one hectare of land needs about 1/10th land for plantlet preparation.

Biomass

About eight to ten tones of wet and dry biomass is required to prepare material for burning on 1/10th hectare of land. Present cost for rice husk, dry cattle dung becomes Rs 2000.

Seeds

5 to 7 kg of rice is required as seed for sowing for plantlet preparation. Present cost becomes Rs 300
Ecological and Economical Assessment of Paddy (*Oryza sativa*) Cultivation in Some Villages of Shahuwadi Tahsil of Kolhapur District of Maharashtra, India

**Water**

It will include charge from corporate water supply system or electricity charge becomes Rs 2000 + Miscellaneous expenses Rs 2000=00 and total becomes Rs 4000=00

**Labour Charge**

(for preparation of land, burning of raab, sowing, replantation of plantlets, pest control, cutting and harvesting)- Total 25 days of labour charge for 15 workers (Rs 85 Rs per day as an average for man and women worker) will be Rs 31,875=00

**Total-Rs 38,175 will be Production Cost from Land Preparation, Cultivation up to Harvesting of Rice on 1 Hectare Area.**

One hectare of land produces about 60 sacs of rice out of these 10 sacs are reserved for domestic food purpose and remaining 50 sacs are sold in market or to agents.

Income of 50 sacs by Rs 900 per sac will be Rs. 45000=00

**Net Profit Will be Rs 45,000 - 38,175 = Rs 6,825=0**

There is no way that an average household can manage its annual expenses on such a small income. Thus the agricultural income has to be supplemented with other sources of income like working on wages.

Therefore, initial cost minimization is necessary through modern plantation methods like nursery grown plantlets from local area.

Plate 4- Labour Intensive Work of Biomass Collection        Plate 5- People Working on Wages to Get Biomass

With this present method does not assure economy of the farmers despite of degradation of the natural flora of the surrounding area. Burning of crop residue reduces supply of fresh organic matter to soil which has negative effect on fertility of the land. Besides this there are long term ecological impacts of this cultivation that innumerable plants are prone to felling and illegal cutting by people carrying out this practice. Growing prices of chemical and organic fertilizers are also making their application difficult. Hence use of organic material as manure is to be promoted amongst the farmers instead of burning and adding to atmospheric emissions. The labour activities like clearing and cutting, which involves outside labors, have negative coefficients and activities like sowing and harvesting which involves more family people as labour have positive coefficient towards input cost. Rice cultivation requires large quantity of water and for producing one kg rice, about 3000 - 5000 litres of water depending on the different rice cultivation methods such as transplanted rice, direct sown rice (wet seeded). This cost of water also adds to investment cost in case of farmers those are dependent on corporate water supply or arrangement of water from neighbours on nominal cost.
DISCUSSIONS

Initial cost investment is higher in Raab type of cultivation as land is to be prepared every year. Of the total farmers 66% believed that there is weed control due to land burning practice where as 34% of the farmers did not agree that it controls weed. If composting of rice husk, cattle dung and other agricultural residue like dry weed is carried to prepare manure on farmland it will add organic supplements and will reduce initial labour charges. This should be convinced to locals and they are to be promoted for scientific cultivation method. It includes proper plantation depth for plantlets, mixing of compost and FYM before replantation, use of nitrogen based supplements at appropriate time. Mulching which retains soil moisture and helps for weed control can be applicable. The prices of fertilizers have grown and transport costs are also higher. Tag is economical and manure also improves the texture of the soil and helps it retain moisture during periods of drought. After the paddy harvest, leguminous crops can be grown in the fields whose soil retains sufficient moisture in the dry season (Muller, 2003). This should be convinced to farmers that burning significant quantities of organic matter, however, is incompatible with the principles of organic agriculture. Hills and slopes in Western ghats are under cultivation of millets and legumes since traditions. People should made aware of role of organic manure and their sources in sustainability of agriculture. Proper microclimate for these areas is to be maintained by sufficient forest cover (Gadgil, 1983). This practice was sustainable initially when population was less and forest was ample. Now a days there is hardly regeneration of vegetation due to reduced fallow period. The situation is same in the Dang district of Gujarat. According to (Chatterjee and Worah, 2004) slash and burn practice was in pace initially when population was sparse and natural recuperation of soil fertility due to large fallow periods was possible. Warli community follows the same system of transplanting as other farmers in the Konkan region. Process is carried out using leaves and twigs from their jungles, a small area of which can provide sustainable yields, since the trees are never destroyed and their jungle does not have to start from scratch every cycle. They lop branches only from trees whose boles will be improved by lopping. This shows that Warlis carry on field research with long-term planning in mind (Gour and Thakur, 2003). Effects of soil nutrient depletion are extending beyond households into the community. This was revealed by farmers saying that there has been fall in grain production since last few years. Soil nutrient depletion lowers the returns to agricultural investment.

Suresh (2001) examined the performance of organic farming in Shimoga district of Karnataka and reported that the cost of paddy cultivation by organic farm was slightly less (Rs. 8,509.52 per acre) when compared to that of inorganic farms (Rs. 8784 per acre). The gross returns were highest in organic farms (Rs. 17, 601.00), while it was Rs. 14,226 per acre for inorganic farming.

In the year 2002, WWF-India implemented a pilot project, on assessment of JFM (Joint Forest Management) at village Ahwati in Maharashtra. Kunbar in Gujarat and Vanchiyode in Kerala. This was an opportunity to develop a deeper insight into status of JFM and challenges ahead in these states. Activities like these can be implemented under the guidance of Forest Department, Agricultural Research Institutes and Academic Institutes.

CONCLUSIONS

Farmers in the study area perform traditional method of rice cultivation. This method is proving to be unaffordable due to scarcity of labors and biomass now days. No any farmer or group of farmers has followed scientific methods like nursery grown plantlets which yields higher than traditional method improving economy. It is observed that, terracing requires a huge capital investment in terms of leveling of the land. This makes farmers to be dependent on external sources to initiate and continue farming practice. On the other hand labour requirement is high for cutting, carrying biomass on land.
Maximum number of farmlands are divided hence there is no use of mechanized farming or use of bullock operated equipments which is adding to labor cost input. Pest resistant varieties are to be used by farmers to minimize expenses on pest control. Due to the lack of any sustainable livelihood and poor economic conditions the local people are mostly dependent on the forest resources for survival. Farmers need to be motivated for agro forestry and participation in forums organized at village, tahsil and district level. Difficulty in getting farm labour for timely agricultural operations has been pointed out by some of the farmers during the discussions. The younger generation in the area does not like to soil their hands by doing farming work. Spread of education and by the idea that manual work is of less dignity, has turned the younger to have a white-collar jobs. This is adding to dependence on costlier manpower from outside area. By use of improved implements and machinery wherever possible through the support of agriculture schemes cost of cultivation can further be reduced. The issue of raab and vulnerability of the forests in the region needs to be deeply probed. Afforestation programmes are to be implemented on all the degraded and barren community forest and with the help of all villagers to cater loss of vegetation hampering local climate in general. Arranging interactive sessions is important to gather information about know how of input cost reduction in Rice cultivation through sharing of ideas and experiences and for encouraging their involvement and contribution in activities related to sustainable management of natural resources to meet their proper regeneration.

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