



MACH (Management of Aquatic Ecosystems through Community Husbandry) is a Government of Bangladesh project supported by USAID. The project partners (Winrock International, Bangladesh Centre for Advanced Studies, Center for Natural Resources Studies, and Caritas Bangladesh) have worked closely with the Department of Fisheries since 1998. The aim was to establish community based co-management and restore and increase sustainable productivity at the ecosystem level in three large wetlands: Hail Haor in Sreemongal, Turag-Bangshi river and wetlands in Kaliakoir and the Kangsha-Malijhee basin in Sherpur. In the wet season these wetlands cover about 32,000 ha, and in the dry season they include over 100 distinct waterbodies. Over 110 villages inhabited by over 184,000 people are directly involved.

Benefits of Contour Cultivation of Pineapple

Pineapple cultivation is a prominent land use in the hills of Hail Haor watershed, a major MACH intervention site in Srimangal Upazila, Moulvi Bazaar District, north-east Bangladesh. The traditional method of pineapple cultivation consists of planting suckers in lines running up and down the steep hill slopes. Such 'down the slope' line planting on the delicate hill slopes results in serious soil erosion. A MACH hydrological study revealed that annually an estimated 100,000 tones of silt and sediment is deposited in the bottom of Hail Haor basin having been eroded from the nearby hills due to such faulty methods of cultivating pineapple and other crops on the hill slopes. Accelerated soil erosion from the hill catchments also affects other haors and wetlands of north-east Bangladesh. This is a major concern for all stakeholders including the government, hill farmers and local wetland resource users as the process degrades the soil for future cultivation, makes hill farming costly and uneconomic, and causes rapid silting up of the stream beds and haor basins, which in turn drastically reduces their productivity as natural fisheries.

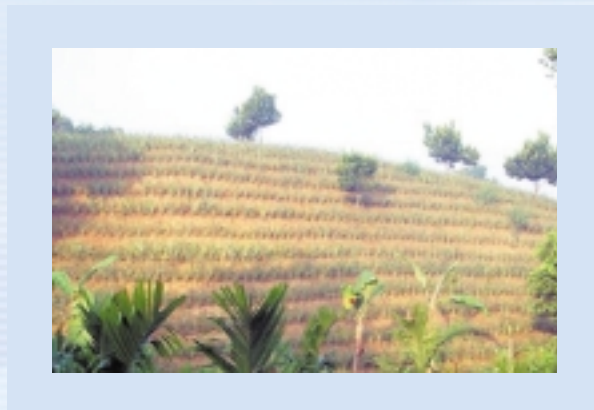
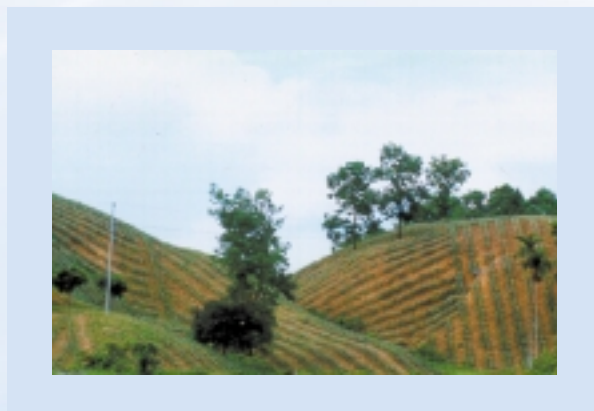
MACH Demonstration

No on-farm trials of alternative less damaging slope cultivation methods had been tried until MACH started contour cultivation demonstrations of pineapple in 2001. MACH selected Mr. Mokon Mian, an enterprising pineapple farmer of Faizabad hills in the Hail Haor watershed, as its pioneer farmer to establish the first contour farming demonstration.

Demonstration site: In 2001, a demonstration plot of 0.22 ha (0.60 acre) was laid out on a prominent hill in one corner of the entrepreneur's traditional pineapple garden. The pioneer was, however, apprehensive whether the outcome from the experimental contour cultivation would be profitable and was thus hesitant to invest his own money. MACH advanced the demonstration plantation cost as a loan to the farmer making it conditional that the first sale proceeds of fruits from the demonstration garden would be provided to MACH in repayment of the project loan (at zero interest).

Witnessing the impressive results of the pioneer farmer's garden, another enterprising leading farmer, Mr. Masud Ahmed of Mohazerabad hill, was easily motivated in 2002 to establish a contour cultivated demonstration plot of 0.28 ha (0.69 acre) in a prominent part of his regular pineapple garden.

Fruiting experience: Depending on the age, plant health and physical growth of the suckers initially planted in a garden, a certain percentage of the pineapple plants bear fruit at the end of the first year, while a still higher percentage fruit at the close of the second year, and almost all plants fruit in the third year. The first two demonstrations have already completed three years and from this demonstration, definite conclusions on the impact and profitability can be reached. The project regularly monitored fruiting incidence,



fruit size and quality, and the overall farm costs and income. Substantial additional profits for the farmers were achieved from three year's fruiting. In addition there are wider long-term benefits to the farmers and the downstream wetland users from reduced soil erosion. The net returns comparing the farmers' demonstration contour plots and their nearby traditionally managed plots are analyzed here.

- i. The contour planting technique enabled the farmer to plant about 4,000 suckers (i.e. 30%) more per acre compared to the traditional cultivation method (sucker capacity is 14,000-15,000 per acre in the traditional method and 18,000-20,000 in contour planting method).
- ii. Fruit harvest from the contour-planted demonstration plots after three years was 25% higher (at 32,530 fruits per acre) than in the traditional cultivation method).
- iii. The fruit size was bigger in the contour cultivation plot: average weight of 2.0 kg, while in the traditional method, in the farmer's adjoining plots, the average weight was 1.5 kg per fruit.

- iv. There was more off-season fruiting in the contour plots compared to traditional gardens and that enhanced farmer income (70-80% higher price for off-season fruit).
- v. At the end of the third year, the net increased income from the contour planting system over that of the traditional cultivation system was about Tk. 75,000 per acre.
- vi. Soil erosion in the contour gardens has been markedly reduced. Such reduction in soil loss benefits the farmer as he has better soil nutrient status, needs less fertilizer, and plants are healthier and yield bigger fruit.
- vii. Being satisfied with the outcome of contour cultivation, the pioneer farmer repaid the entire demonstration plantation investment cost while the other farmer did not ask for financial assistance. Subsequently, both farmers decided to adopt contour cultivation in all their future pineapple gardening, and many other farmers are following their example.

Cost-benefit assessment of contour demonstration compared with traditional cultivation practice (Tk/acre)

| Traditional cultivation method | | | Contour cultivation method * | | | Incremental benefit per acre from contour method (Tk.) |
|--------------------------------|-------------------------|--------------------------------|------------------------------|-------------------------|--------------------------------|--|
| Plantation cost (Tk.) | Income from fruit (Tk.) | Net profit (+) /Loss (-) (Tk.) | Plantation cost (Tk.) | Income from fruit (Tk.) | Net profit (+) /Loss (-) (Tk.) | |
| 66,330 | 119,600 | (+) 53,630 | 66,700 | 195,320 | (+) 128,620 | (+) 74,990 |

* This data is from the first, second and third years of two contour plantation demonstration plots of size 0.60 and 0.69 acre compared with neighboring plots of the same size pursuing traditional cultivation. Figures are standardized to one acre size for easy comprehension. See back page for details.

Collaboration with the Winrock Farmer to Farmer Volunteer Program

To encourage pineapple growers to change their destructive traditional planting pattern, MACH collaborated with the Winrock Farmer-to-Farmer (FTF) Volunteer Program in obtaining the services of an experienced pineapple grower to work with the farmers of the Hail Haor watershed. Accordingly, Mr. Roy Betty an experienced pineapple farmer from the USA visited the MACH project demonstration site in 2002. The volunteer conducted field workshops at the site with the demonstration farmers as well as with other pineapple growers on the newly introduced contour planting techniques. This helped a lot in motivating the local growers and demonstrating the positive aspects of the contour planting method. In addition, the volunteer provided guidance to the growers on the need for and advantages of changing the season for establishing pineapple gardens from the traditional April-June period to November-January. He also advised on increasing plant density to an optimum where yields are higher and the hill surface is more effectively covered to further reduce runoff and soil erosion.

MACH Extension and Motivational Activities

MACH conducted field workshops with local pineapple growers on the contour cultivation method. In addition to plantation techniques, guidance was provided to growers on how to increase the density of the pineapple plants thereby increasing fruit yield and more effectively covering the hill slope surface in a bid to reduce runoff and soil erosion. Observing the positive and attractive results of the demonstration plots, seven more farmers opted to adopt the same cultivation method during 2002. In 2003, 2004 and 2005, 17 more farmers plus the old farmers undertook this new method of contour cultivation on a bigger scale on 59 plots totaling 86 acres, giving an expansion to 26 farmers and 72 plots (over 92 acres) in five years. This is a significant breakthrough in changing the pineapple farmers'

attitude towards adoption of better cultivation methods and techniques.

The project finished up with a farmers' field day and workshop on 31 July 2006 in Sreemongal where a majority of the pineapple farmers in the Hail Haor watershed came together. Farmers from adjacent areas of Kolaura and Borolekha Upazilas of Moulvi Bazaar District; Department of Agriculture Extension (DAE) officials from central level, Sylhet Division, Moulvibazaar District, and Sreemongol Upazila; and local Union Parishad members also attended. Total participation was 113, of which 76 were pineapple farmers and 37 were from government. All farmers present agreed that they would follow contour planting in the future. The DAE also agreed to follow up on MACH's efforts and promote only contour planting in the future.

Policy Recommendations

Backed by the on-farm demonstration plantation data, and qualitative and quantitative assessments with the farmers, MACH is recommending formal policy changes to the Upazila Nirbahi Officer, Sreemongol; Deputy Commissioner, Moulvi Bazaar District; and Ministry of Land.

Firstly, we believe that the evidence justifies the Government of Bangladesh formulating a set of rules for pineapple cultivation which make adoption of contour cultivation techniques a mandatory obligation for all hill farmers of the country. Since much of the land cultivated with pineapple is leased from the government, there is an opportunity to direct farmers to adopt good practice.

Secondly, extension of contour planting of pineapple, and similar trials for other crops in hill areas are needed. This would motivate the farmers and private landowners to adopt this practice for their own interest as well as for the environmental protection of the watersheds. To achieve this, the DAE should give a higher priority to extension messages for hill farmers and have as one of its objectives a total change over to contour cultivation and the elimination of the erosion promoting traditional cultivation methods.

Advantages and disadvantages listed by the farmers for the two cultivation methods

A. Contour Cultivation Method

| Advantage |
|--|
| a. Protects land from soil erosion |
| b. Preserve soil fertility and conserve more water |
| c. Less weed growth and maintenance cost |
| d. Fruit size is bigger |
| e. Earns more profit for the grower |
| Disadvantage |
| The only disadvantage is the one quoted by laborers who complain of discomfort felt by them in walking and working between pineapple rows. [This seems to be a mind set problem rather than actual problem because walking is easier along contour line than climbing up and sliding down] |

B. Traditional Cultivation Method

| Advantage |
|--|
| Laborers feel comfortable because they are used to this method. |
| Disadvantage |
| a. 2-3 inches of fertile top soil is eroded per year |
| b. Requires more fertilizer meaning more cost |
| c. Fertilizer applied is quickly lost being washed out by rain water |
| d. Overall soil fertility loss occurs in a relatively short time |
| e. More weed growth and higher maintenance cost |

Summary

Contour planting allows 30% more pineapple plants to be cultivated per acre. It reduces soil erosion and therefore reduces the need for fertilizer and weeding, leaving input costs unchanged in the short term but in the long terms substantial gains would accrue. This system produces larger fruits resulting in a 62% increase in sale value; and more than doubles the profit from the first three years of cultivation to about

Conclusion

After seeing the performance of the demonstration plots, pineapple farmers in the area appreciate the benefits from contour planting. Those who have pioneered the adoption of contour planting techniques are establishing their new pineapple gardens following this technique. Some people are still hesitant so there is still work to do.

However, persistent motivation and continued extension endeavors have a good potential to bring about a total change to contour cultivation of pineapple instead of the traditional up and down slope line planting technique.

A three pronged approach to the problem is needed for sustainable results:

- Motivational activity should continue and expand further to new areas through strengthening of extension services.
- Awareness raising of the problems with up-down slope planting and benefits of contour planting should be expanded through electronic and print media for public motivation.
- Land use regulations, appropriate policy and rules need to be formulated and promulgated by the government to protect the soils of the country's sloping landscape.

Detailed Cost-Benefit Analysis (per acre)

Averaged data from two demonstration plots of 0.60 and 0.69 acres has been converted into per acre figures.

Cost comparison of traditional and contour cultivation methods

| Input | Traditional method | | | Contour method | | |
|---|--------------------|------------|---------------|-----------------|------------|---------------|
| | Quantity | Rate (Tk.) | Cost (Tk.) | Quantity | Rate (Tk.) | Cost (Tk.) |
| Land preparation & soil working | | | | | | |
| Ground breaking (first hoeing) | 101 days | 50 | 5,050 | 101 days | 50 | 5,050 |
| Second hoeing | 47 days | 50 | 2,350 | 47 days | 50 | 2,350 |
| Debris cleaning and final soil preparation | 14 days | 50 | 700 | 14 days | 50 | 700 |
| Sub-Total | 162 days | 50 | 8,100 | 162 days | 50 | 8,100 |
| Fertilizer application | | | | | | |
| Urea | 1,200 kg | 5.5 | 6,600 | 1,060 kg | 5.5 | 5,830 |
| MP | 809 kg | 10 | 8,090 | 725 kg | 10 | 7,250 |
| TSP | 370 kg | 12 | 4,440 | 343 kg | 12 | 4,120 |
| Labor 1st year | 15 days | 50 | 750 | 15 days | 50 | 750 |
| Labor 2nd year | 15 days | 50 | 750 | 15 days | 50 | 750 |
| Labor 3rd year | 25 days | 50 | 1,250 | 25 days | 50 | 1,250 |
| Sub-Total | — | — | 21,880 | — | — | 19,950 |
| Pineapple sucker & planting cost | | | | | | |
| Pineapple sucker | 14,460 | 1.20 | 17,350 | 18,740 | 1.20 | 22,490 |
| Planting labor | 47 days | 50 | 2,350 | 73 days | 50 | 3,650 |
| Sub-Total | — | — | 19,700 | — | — | 26,140 |
| Weeding and cleaning | | | | | | |
| Year 1 | 5 times | 1,670 | 8,350 | 3 times | 1,690 | 5,070 |
| Year 2 | 3 times | 1,670 | 5,010 | 2 times | 1,890 | 3,780 |
| Year 3 | 3 times | 1,130 | 3,390 | 3 times | 1,220 | 3,660 |
| Sub-Total | — | — | 16,650 | — | — | 12,510 |
| Grand total of expenses | | | 66,330 | | | 66,700 |

Fruit production and value by year from planting

| Year | Traditional method | | | | Contour method | | | |
|--------------|--------------------|------------|-----------------------------------|----------------|----------------|------------|-----------------------------------|----------------|
| | No. of fruit* | % fruiting | Av. unit rate (price range) (Tk.) | Value (Tk.) | No of fruit* | % fruiting | Av. unit rate (price range) (Tk.) | Value (Tk.) |
| 1 | 6,700 | 46% | 3.93 (3.5-5) | 26,330 | 8,220 | 44% | 4.92 (4-5) | 40,450 |
| 2 | 10,430 | 72% | 4.66 (4-6) | 48,600 | 13,560 | 72% | 6.34 (5 - 9) | 85,970 |
| 3 | 8,830 | 61% | 5.10 (4-8) | 45,080 | 10,750 | 57% | 6.41 (5 - 9) | 68,900 |
| Total | 25,960 | | | 119,960 | 32,530 | | | 195,320 |

* Traditional method average fruit weight: 1.5 kg; Contour method average fruit weight: 2 kg.

Differences in costs and income between traditional and contour method of pineapple cultivation

| Input | Traditional method (Tk.) | Contour method (Tk.) | Difference (Tk) (-) Less for contour method(+) More for contour method |
|----------------------|--------------------------|----------------------|--|
| Land preparation | 8,100 | 8,100 | 0 |
| Fertilizing | 21,880 | 9,950 | (-) 1,930 |
| Sucker planting | 19,700 | 26,140 | (+) 6,440 |
| Weeding and clearing | 16,650 | 12,510 | (-) 4,140 |
| Total costs | 66,330 | 66,700 | (+) 370 |
| Total income | 119,960 | 195,320 | (+) 75,360 |
| Net income | 53,630 | 128,620 | (+) 74,990 |

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