Case study paper

Sharing lessons

Hazard Risk Preparedness in Agriculture: Good Practice Examples from South and South East Asia

Project TCP/RLA/3101

Assistance to improve Local Agricultural Emergency Preparedness in Caribbean countries highly prone to hurricane related disasters

Submitted by

Asian Disaster Preparedness Centre (ADPC)
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Hazard Risk Preparedness in Agriculture: Good Practice Examples from South and South East Asia

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Assistance to improve Local Agricultural Emergency Preparedness in Caribbean countries highly prone to hurricane related disasters

by

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Photo on cover page: Community drinking water well in drought prone Savannaket Province, Lao PDR

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1. Disaster Risk Reduction in agricultural sector

On the occasion of the World Conference on Disaster Reduction (WCDR) in Kobe, Japan (January 2005) governments, UN agencies and civil society strongly called for moving from relief to concrete action in disaster risk reduction. Building on the recommendations of the WCDR the General Assembly Resolution (March 2005) on International Cooperation on Humanitarian Assistance in the Field of Natural Disasters, from Relief to Development calls upon all States to adopt, and requests the international community to continue to assist developing countries, appropriate measures to mitigate the effects of natural disasters and integrate disaster risk reduction strategies into development planning.

FAO has been addressing since the early 1970s various needs in relation to food and agricultural emergencies and has been developing numerous initiatives related to disaster risk management different areas (e.g. early warning systems; vulnerability assessments; agricultural relief operations; drought management strategies; pastoral risk management; soil and water conservation practices; improving safety at sea for small scale fishermen, wild land forest fire management etc.,). More recently, FAO has also launched activities to better integrate aspects of proactive disaster risk management into ongoing agricultural sector development work, and to assist member countries in their efforts of shifting from reactive emergency relief operations towards better planned, long-term disaster risk prevention and preparedness strategies. The key entry points of FAO in this regard build on the following closely interconnected questions: (i) what are the institutional structures, capacities and processes that are driving national DRM programs in agriculture and allied sectors, and (ii) what are the technical capacities, tools, methods and approaches in place to operationalize disaster risk management at national and local levels, and (iii) what are existing good practices which are or have been successfully applied to strengthen community and national resilience against climate and other natural hazards. This type of Strengths Opportunities Weaknesses and Gaps analysis is used to design and implement jointly with national and local partners situation specific and demand responsive interventions and projects to strengthen disaster risk management, in particular prevention, and preparedness. Recent FAO supported projects on disaster risk management in Asia Pacific and Caribbean have shown good results especially in identifying and demonstrating locally relevant *"good practices".*

Within the broader framework of disaster risk management and regional cooperation, and in light of the above priority identified in the Hyogo Framework for Action, the Asian Disaster Preparedness Centre (ADPC) is well placed to share the local level good practices identified from its member countries in the Asian region for consideration to replicate in similar situations in Caribbean after careful review. In 2006, FAO and ADPC have signed a Memorandum of Understanding about sharing lessons and collaboration towards the implementation of the Hyogo Framework for Action.

2. Sharing of good practices and lessons at Regional and Cross regional levels

One of the priorities identified in WCDR process, and manifested in the Hyogo Framework of Action (2005 – 2015) is to promote regional programs including for technical cooperation, capacity development, the development of methodologies and standards for hazard and vulnerability monitoring and assessment, the **sharing of information** and effective mobilization of resources (WCDR, 2005). The regional and cross regional sharing of lessons and good practices depends on concrete exchange platforms to be established and operated.

The Regional Workshop held under the FAO project "**Assistance to improve Local Agricultural Emergency Preparedness in Caribbean countries highly prone to hurricane related disasters"** in Kingston in January 2007 provided an excellent platform for sharing some practical lessons on good practices for DRM, collected at field levels in four different Caribbean countries (Cuba, Haiti, Grenada Jamaica) primarily; through the involvement of ADPC it was also used as opportunity to promote cross-fertilization and exchange between regions.

Asia: Asia has a long history of disasters and resulting reactions and reforms, including policy initiatives, legislative actions, and creation of new initiatives on disaster management programmes. However, recent disaster data show that natural hazards are increasing in frequency and intensity (EM-DAT, 2006). Recurrent natural disasters such as droughts, floods, and tropical storms have devastating impacts on the agriculture, livestock and fisheries, threatening the rural livelihoods. The World Bank estimated that economic losses worldwide in the 1990s could have been reduced by US$280 billion if US$40 billion had been invested in preventive measures, indicating a cost/benefit ratio equal to 7. The Asian region experiences nearly a half of the world's natural disasters. Among the disasters, drought, floods and cyclones devastate many countries in Asia with grim regularity year after year. They are spiraling out of control, increasing in frequency, causing more and more injury, disability, disease and death, adding to the health, economic and social burden of already impoverished nations. From 2000 to 2005, the total economic damage and loss in eleven selected countries of Asia worked out to 62 655.9 millions due to disasters like drought, extreme temperature, flood, wave surge and wind storm.

Natural disasters have caused more devastation in Asia in the last decade than ever before. Each year 150 to 263 disasters were reported in the nineties. About 130 million people were killed, injured, rendered homeless or otherwise seriously affected by natural disasters. Large parts of Iran, India, Pakistan, Afghanistan, and several Central Asian countries are affected by two to three consecutive years of drought. The DPR Korea and Mongolia suffered from the after-effects of an extremely harsh winter following earlier disastrous years of alternating floods and droughts. Recently some parts of South East Asia experienced cereal production shortfalls due to reduced rainfall and widespread flooding. In total natural disasters create food insecurity problems in Asia.

The Asian Disaster Preparedness Center (ADPC) has been implementing, since 1998, projects on Disaster risk management and has field experience through ongoing projects in Indonesia, the Philippines, Vietnam, Laos, Cambodia, India and Bangladesh. These projects offer a broad basis of experiences, lessons learned and good practice examples which may, with some location specific good practices, be of high value added to the lessons learned exchange process, initiated by the TCP in the Caribbean Region.

Caribbean: The Caribbean region suffers from very high consumption volatility, which could be the result of the regions proneness to natural disasters (Rasmussen, 2004). The levels of losses in major disasters demonstrate the economic importance of reducing vulnerability in Caribbean region. Given the small size of Caribbean states, the impact of a major hurricane can affect the entire national community. Hurricane Gilbert in 1988 caused Jamaica losses worth 65 percent of GDP. Hurricane Hugo in 1989 caused Montserrat losses worth 200 percent of GDP. Flooding and landslides from Tropical Storm Debbie in 1994 caused Saint Lucia losses worth 18 percent of 1993 GDP. Hurricanes Luis and Marilyn in 1995 caused Antigua and Barbuda losses worth 65 percent of the GDP. Hurricane Ivan, the strongest of the 2004 Atlantic Hurricanes season pass through Grenada caused widespread damage and loss. According to the Centre for Research on the Epidemiology of Disasters (2005), at least 6,000 lives were lost, and over one million people were affected by natural disasters in the region in 2004. The active hurricane season during 2004 resulted in damages approximating US $5.7 billion. The productive sectors including agriculture accounted for over one third (35.2%) of associated damages and losses. Such events have exposed the socio-cultural and environmental vulnerabilities of the Caribbean basin, and the urgent need to rethink disaster management options.

Cross regional exchange: The nature of hydro-meteorological disasters affecting agriculture sector in these two regions are very similar. There are many similarities with respect to climatic conditions and types of farming systems. Thus, the sharing of experiences between the project countries, FAO regional project focal points and the Caribbean Disaster Emergency Response Agency (CDERA) was considered beneficial to promote the exchange and possible replication of good practices relevant to both of these two regions.

3. ADPC involvement and contribution to the workshop

Within the above workshop context, the objectives of the ADPC's involvement were:

1. to review available documentation and ADPC implemented projects and document 5-10 selected good practices examples related to the topic and likely to be of value added to the Caribbean Region in a concise technical case study paper.
2. to contribute to the regional learning exchange process initiated under the TCP RLA 3101 including participation at a three-days technical regional workshop, held in January 2007 in Kingston, Jamaica.
3. to give a presentations on (i) good practice examples from SE Asia and (ii) climate forecast applications for disaster preparedness in the Agriculture sector which may be of relevance to the Caribbean Region.

4. Good practice examples

Good practice examples from in the agriculture and/or forestry sectors presented in this report are "real, field evidence-based" examples and relate to mitigation and/or improved preparedness for response to hydro-meteorological hazard risk. Two types of examples are address:

1. The institutional arrangements which had good impacts related to mainstreaming of disaster risk management concerns into agriculture and allied sectors.
2. Practical feasible and economically viable disaster risk management techniques relevant to Caribbean region and are correspond to DR related issues

such as, environmental management, conservation agriculture, improved soil management, and water (shed) management, local land use planning, cropping patterns, storm/flood "resistant" planting techniques, and also integrated measures possibly combining some/several of above and techniques/good practice examples related to early warning systems.

Table 1: Summary of good practice examples documented from South and South East Asia that are relevant to Caribbean region

Sl.No.	Good practice example	Hazard context	Adopted from	Relevance to Caribbean
1.	Multi-storied cropping	Soil erosion, wind storms, land slides	Kerala, India	High rainfall areas in Grenada
2.	Integrated Sylvi-pastoral, hedgerow systems	Drought, soil erosion	Southern India	Low to medium rainfall areas in Haiti
3.	Multi-purpose wind breaks/shelter belts	Wind storms and erosion	Hue, Vietnam	Hurricane prone areas
4.	Small scale farm ponds	Drought	North West Bangladesh	Low rainfall Haiti
5.	Vertical mulching	Drought	Southern India	Drought prone areas in Jamaica and Haiti
6.	Contour cultivation with vegetative barrier	Drought, erosion, floods	Southern India	Sloppy terrains in Grenada, Jamaica, Haiti and Cuba
7.	Raised bed Lotus cultivation	Floods	Quang Tri, Vietnam	Flood prone areas (Guyana)
8.	Floating Vegetable gardens	Floods	Coastal Bangladesh	Flood prone areas (Guyana)
9.	Community weather observation systems	Hydro-met hazards	Tamil Nadu, India	All countries
10.	Climate Field Schools	Hydro-met hazards	West Java, Indonesia	All countries
11.	Weather and climate forecast application	Hydro-met hazards	Bangladesh and Indonesia	All countries

4.1 Multi-storied cropping

Place: High rainfall zones of Western Hill Ranges in India (Kerala, Tamil Nadu).

Historical perspective: The practice is prevalent among the farmers in India. The optimal plant geometry was improved by intervention of research institutions recently.

Hazard context: High intensity rainfall, soil erosion and land slides.

Description: The high rainfall zones in Southern India (Kerala and Tamil Nadu) are affected by soil erosion and land slides. Initially coconut, areca nut, banana single cropping systems were practiced. These practices and continuous soil disturbance due to intensive cultivation lead to severe soil erosion enhanced by high rainfall. The steep slopes in the hilly terrains also contributed to this erosion. Later farmers grew multiple crops on the same land. Farmers adopt innovative multi-storied cropping systems to improve the soil stability and fertility status. The multi-tiered cropping systems involve coconut, areca nut, banana, pineapple, turmeric and pepper (Ghosh, 1999). The crops underneath the tall trees withstand shade effects and provide ideal climatic conditions for all the crops. The rate of soil erosion was found to be reduced by up to 90%.

Suitability: The practice is suitable for zones with more than 2000 mm of rainfall. It is also recommended on steep slopes to protect the soil and reduce soil erosion.

Possible beneficiaries: Small farmers benefit most from the system. Crop intensification provides a high land equivalent ratio.

Cost estimate: The practice requires no additional costs for cultivation of multiple crops. In fact, the total cost of integrated cultivation is low compared to the costs required for growing these crops separately.

Implementation: The practice can be implemented throughout the year. Re-planting is required for annual crops.

Maintenance: Perennial crops require regular annual pruning and other intra-cultural operations.

Benefits: The practice is suitable for small farms in high rainfall zones for efficient resource utilization and soil conservation. The risk of yield loss can be shared among enterprises. Failure of one crop may be compensated through optimal production from other crops. The shade loving crops are grown in the bottom layer, while the tall crops occupy the top layers within the multi-storied system. The household income and employment opportunities are increased many folds.

Institutional support: Institutional and research support are required to identify suitable plant species in different layers within the multi-storied cropping system. Technical capacity building is required with regard to selection of optimal plant species, spacing, fertilizer schedule and other intercultural operations. Institutional support is required to supply planting materials during appropriate season.

4.2 Sylvi-pastoral and hedgerow systems in integrated farming systems

Place: Low rainfall uplands in peninsular India.

Historical perspective: Combining different activities to diversify livelihoods and income dependencies is an age old practice among the low income small farmers in semi-arid India. However, recent research and development work has identified an optimized mix of household strategies for drought risk management in semi-arid tropics.

Hazard context: Drought, soil erosion.

Description: Farmers in semi-arid tropics are practicing more than one type of enterprise in their farming systems to reduce the risk of drought. Losses of revenues from one enterprise will be compensated from others. Most suitable integrated farming system for rain fed uplands, receiving less than 700 mm of annual rainfall, is sylvi-pastoral and sylvi-agriculture systems.

One of the examples for low rainfall areas is *Acacia leucophoea* + *Cenchrus ciliaris* based sylvi pastoral system (DA, 1995). The system gives adequate fodder for the goat and sheep and fire wood to meet household requirements. Annual crops like Maize and sorghum can be grown in between the tree rows to maximize the benefits under sylvi-agriculture systems. The practice is suitable for protecting the soil and reducing soil erosion. Similarly, *Leucaena leucocephala* (Lam.) may be planed as single or multiple hedgerows depending on the rainfall pattern and type of alley cropping component. In the multiple hedgerows, the rows may be closely spaced (75 – 100 cm) to achieve maximum yield per hectare for cutting- and- carry feeding or more widely spaced (3 – 10 m) for alley cropping or grazing. Forage grasses may be planted in widely spaced rows for grazing, grasses may be planted between leucaena rows to increase total fodder supply to animals. *Panicum maximum*, *Digitaria decumbens* and *Cenchrus ciliaris* have been found to be successful companion grasses for leucaena. The hedgerows system is useful as windbreaks and is suitable for wide range of rainfall environments from 650 to 3000 mm (Suttie, 2006).

Suitability: The Acacia Leucophoea + Cenchrus Ciliaris sylvi-pastoral system is most suitable in low rainfall zones with less than 700 mm. It is also effective to protect the soil from excess erosion on steep slopes. The Leucaena based alley systems performs well in a wide range of rainfall environments from 650 to 3000 mm. However, extreme dry conditions and water stagnation in impeded drainage soils are not suitable.

Possible beneficiaries: Small farmers benefit most from the system; also landless people with livestock may benefit, if collaborative arrangements with farmers can be made.

Fig. 1: ***Acacia Leucophoea* + *Cenchrus ciliaris* sylvi-pastoral system in Southern India**

Cost estimate: The cost of implementation of sylvi-pastoral systems is relatively low. The initial costs include preparation of pits for planting tree species and grass cuttings. The grass cuttings can be collected from existing pastures.

Implementation: Provision of spacing, row arrangement to reduce the shade effect and stocking rates need to be decided based on the type of tree species and rainfall pattern.

Maintenance: Minimum maintenance costs for pruning, maintaining small scale basins surrounding the trees to facilitate water harvesting.

Benefits: The practice reduces the risk of complete production loss in droughts. The employment opportunity for small farmers is increased and the available resources will be effectively utilized.

Institutional support: Adequate awareness about the use of sylvi-pastoral systems is required. Technical support about the cultivation aspects for growing tree species and grass are required. Provision of quality tree seedlings is important.

4.3 Soil conservation through multi-purpose wind breaks/shelter belts

Place: Coastal areas prone to soil erosion due to strong winds.

Historical perspective: Traditional tree species are used to protect the soils along the coasts prone to severe wind erosion. Recent interventions of local institutions and community based organizations promoted the planting of multi-purpose tree species which hold promise for both soil conservation and other benefits.

Hazard: Wind erosion, typhoons, and tropical cyclones.

Description: Coastal areas in Vietnam are prone to soil erosion due to dry winds during summer season, and winds accompanying typhoons during rainy season. Severe soil erosion and accumulation of sand dunes, salt encrustation on the surface soil has reduced the productivity of lands. In addition, the fertility status of soils was further reduced substantially due to removal of the top soil. To break the cycle of further degradation several tree species were identified and seedlings were raised through community nurseries. The most important trees species identified by the local institutions and the community are Eucalyptus and Cashew. Cashew trees were usually established on degraded soils in the central coastal provinces. The current spacing applied is 10m x 5 m (200 plants/ha). Before 1990 however, farmers resorted to high density planting as high as 400 trees/ha. The tree species were found to be resistant and effective in reducing soil erosion and wind speed substantially.

Fig. 2: Wind breaks in central Vietnam - Eucalyptus and Cashew plantations

Suitability: The practice is highly suitable for degraded soils in the coastal regions prone to wind and water erosion. The tree species are also suitable for moderately saline soils.

Possible beneficiaries: The beneficiaries of the practice are the land less labourers, wage earners and handy craft makers. They can use the resources for their livelihood diversification.

Cost estimate: The practice requires minimum costs for establishment of plantations. Participation of community members and local disaster management committees can reduce the cost of establishment.

Implementation: The practice may be implemented in coastal areas through community based organizations. Provision of spacing, row arrangement, row direction need to be decided based on the type of tree species and rainfall pattern.

Maintenance: Minimum maintenance costs for re-planting, water control structures along the streams like check dams to reduce the over land flow of water.

Benefits: The practice is suitable for local communities for protecting the natural resources and also to diversify the livelihood activities.

Institutional support: Adequate awareness about the use of tree species in wind breaks, spacing between the trees to minimize the mutual shade effect and also to protect the soil is required. The local institutions can supply the tree saplings through community nurseries.

4.4 Small scale water harvesting structure (mini farm-ponds)

Place: Areas in NW Bangladesh prone to drought spells.

Historical perspective: The practice was introduced through local NGO to better manage drought spells in the Barind areas of North Western Bangladesh; however, it is not wide spread due to the lack of investment capital and organization among poor farmers.

Hazard context: Drought spells.

Description: Re-excavation of ponds is beneficial to store excess rain water in areas of water scarcity, preferably in (at least slightly) sloping terrains (FAO, 2006). If land is found on a voluntary basis, new excavation may be taken up with the concurrence of the farmer. In farmlands with no irrigation source, rainwater harvesting done through mini-ponds can provide supplemental irrigation. Miniponds of 5m x 5m x 2m (length x breadth x depth) are preferred in small farms. It is also proposed to excavate larger ponds (10m x 10m x 2m) as per requirement and rainwater availability. Farmers preferred to have these miniponds in a corner of their field.

Suitability: The practice is highly suitable and cheap in low rainfall zones with less than 1000 mm rainfall and where clayey soils are predominant; Ponds can be constructed without cement in heavy clayey soils. This practice is also effective on steep slopes to harvest the excess rain water, however exposure to steep topography may require wall enforcements.

Possible beneficiaries: Small and medium farmers who own the lands. Local communities also benefit as they can use the excess water for other purposes like rearing fresh water fish.

Cost estimate: Excavation of mini-ponds requires minimum costs in Bangladesh, where soil conditions are suitable. Where ever family labour is available it is considered to be very cheep. The soil excavated can be used for construction of low cost house (mud walls). The cost of excavation of a mini-pond in NW BGD was estimated at US$40. Under sandy soil conditions where cement is needed costs will be significantly higher.

Fig. 3: Farm ponds for rain water harvesting in North West Bangladesh

Implementation: The practice may be replicated to other similar areas through local institutional support. Design aspects needs to be considered based on the soil type, rainfall patterns and requirement of water for supplemental irrigation.

Maintenance: Minimum maintenance cost for de-silting is required once in a year.

Benefits: The practice is suitable for small farms in low rainfall regions for water harvesting and soil conservation. The drought impacts can be reduced by providing supplemental irrigation when the crop is facing intermittent and long dry spells. During short duration dry spells, yield losses can be avoided.

Institutional support: Adequate awareness about the utility of ponds needs to be created with the local community. Technical support about the design and excavation of mini-ponds required to be available for the farmers. Improved access to micro credits which qualify for this purpose could facilitate broader replication.

4.5 Vertical mulching

Place: Southern Peninsular India.

Historical perspective: The practice was introduced through the agricultural extension department and dry-land research centres. It is complementary to the surface mulching advocated for soil moisture conservation.

Hazard: Drought, sheet erosion.

Description: Drought is common future in a highly variable semi-arid peninsular India. Rainfall is seasonal, dominant during north east monsoon season (Oct-Dec). The length of growing period is less than three months and annual crops like maize, sorghum and grain legumes suffer from water stress. Soils are unable to store much of the available water due to heavy run-off. Surface mulching retains water but not sufficient to provide adequate water to plants. A practice of vertical mulching is found to be very effective under low rainfall both in shallow and heavy soils. Channels of 30 cm depth are formed along the contour with an interval of 100 cm between two channels. The channels are filled with crop residues and decomposable farm wastes. The channels filled with sufficient residues slow down run off and thus provide adequate opportunity time for infiltration of rain water. The annual crops like sorghum, maize and pulses can be grown on either side of the channel so as to use the stored moisture effectively.

Suitability: The practice is suitable for low rainfall uplands with a rainfall of <1000 mm. This is effective in heavy soils with a slope of <5%. However, moderately deep channels are also recommended in slop lands.

Possible beneficiaries: The resource poor small farmers under upland rain fed condition will benefit from the practice.

Cost estimate: The costs for forming the channels and spreading of crop residues in the channels are the major expenditures. The use of mechanical tillage devices can reduce costs.

Implementation: The practice can be implemented before the start of the rainy season so that from the first rainfall event water can be effectively stored in the soil.

Maintenance: The channels need to be formed newly every year before planting. Transport of crop residues from outside the farm may not be economic. The use of crop stubbles may reduce the cost of maintenance of vertical mulching.

Benefits: The practice reduces soil erosion and conserves the rain water effectively. The fertility status can be improved due to presence of organic materials.

Institutional support: Institutional support is required to facilitate the access to and use of mechanized low cost implements for forming the channels/furrows.

4.6 Contour cultivation with vegetative barrier

Place: Southern India.

Historical perspective: The practice was traditionally applied by farmers under rain fed conditions. It was further disseminated through the agricultural extension department into other similar areas.

Hazard context: Drought, high rainfall and erosion.

Description: Vegetative barriers on contours are raised to guide the farmers towards taking up all farm activities like ploughing and planting along the contour. The barriers can be constructed at intervals of 20-30 meters, and on slope inclinations of up to 5%. The barriers will abstract the runoff water and prevent erosion. Vetiver, lemon grass, *Cenchrus ciliaris* and agaves are the suitable as vegetative barriers in drought prone low rainfall areas.

The practice can also be implemented in high rainfall areas with steep slopes. The grass species need to be evaluated before planting. The ideal characteristics of the grass species are fast growing, with good soil binding capacity and tolerance to both drought and water stagnation. The grass species should be planted during the rainy season to ensure establishment. Vetiver hedges can be planted on the contour with the fruit trees. Competition between the vetiver and adjacent fruit trees is minimal because of the vertical nature of the vetiver rooting system as has been shown in Vietnam.

Suitability: The practice is suitable for both low and high rainfall areas. Vetiver grass barriers can survive extremes of drought, heat, water logging, pH, and, to some extent, cold. It is insensitive to photo period and grows year-round where temperatures permit.

Possible beneficiaries: Particularly resource poor upland farmers can benefit from the practice.

Cost estimate: The primary costs relate to the establishment of grassy contours. Initial costs incur from the forming of raised beds along the contour to facilitate grass planting.

Implementation: The practice should be initiated during the rainy season in order to facilitate the quick growing of vegetative barrier.

Maintenance: The bunds for vegetative barriers need to be maintained after tillage. Prolonged dry spells may affect the vegetative barrier and may require extra care during the next season.

Benefits: The practice reduces soil erosion and conserves the rain water effectively. The fertility status can be improved due to presence of organic materials. Vetiver has a myriad of on-farm and other uses besides those mentioned above, including, for example, use as a living fence and boundary marker. The leaves and roots of vetiver can be used for an extensive range of handicrafts and are excellent for thatching. The young leaves are palatable to livestock and have about the same nutritive value as Napier grass (Pennisetum purpureum). It is used domestically in cooking and insect control and also has medicinal properties.

Institutional support: Institutional support may be required to encourage the use of mechanized low cost implements to form bunds along the contour.

4.7 Raised bed lotus cultivation

Place: Quang Tri provice of North Central Vietnam.

Historical perspective: The practice was invented by local communities. However, there was no initiative to promote and disseminate this practice. Initially community collected lotus seeds from the plants grown in common water bodies and sold them in the market. Only recently the suitability of broader replication of the practice for flood prone areas was recognized, and communities were promoted for cultivating lotus in flood prone low lying areas under raised beds.

Fig. 4: Raised bed lotus cultivation in Central Vietnam (Photo: R. Selvaraju)

Hazard: Flash flood and cyclone prone low lying areas of central Vietnam.

Description: Flash floods, water stagnation and cyclonic storms are common features in Vietnam. The North Central Region of Vietnam is specifically prone to these extreme events as it is on the tracks of cyclonic storms. Small farmers in this region leave their land fallow during rainy season between September and December due to excessive water stagnation. Communities in this area practice lotus cultivation in raised beds with a height of 30 to 50 cm and a width of 100 cm. These raised beds create a favourable soil condition and the excess water is drained through the wide channels (100 cm). On the raised beds, the lotus seeds are sown.

Suitability: The practice is suitable for typhoon and cyclone prone areas of North central Vietnam. The practice is successful under fresh water eco-systems with heavy textured soils. Locations exposed to saline water intrusion are not suitable.

Possible beneficiaries: The beneficiaries are small farmers and local small businessman. This practice provides employment opportunities during flood season and increases household income.

Cost estimate: Initial cost of land preparation is substantial. The family labourers can be engaged in preparing the raised beds. The lotus seeds are available locally for cultivation.

Implementation: The practice could be implemented during rainy season from September to December in low lying areas of Vietnam.

Maintenance: It does not require any maintenance costs. The raised beds need slight rectification every year before start of the rainy season.

Benefits: The lotus seeds are high value products and can be sold on local markets. The seeds are used in confectioneries and for ice cream making. This practice provides additional income to poor households and provides employment opportunities to farm women.

Institutional support: Institutional support is required to disseminate this practice to other ecologically similar regions. Local market facilities to procure the lotus seeds need to be established and to be connected with export institutions. Modes of exploitation through middle men need to be reduced through institutional interventions. Good quality seeds of lotus need to be provided from the district agriculture department. Local community based organizations and financial institutions need to be strengthened to promote replication of the practice.

4.8 Floating vegetable gardens

Place: Khulna, Pirojpur districts of coastal Bangladesh

Historical perspective: The practice was initially invented by local communities during the 1980's after devastating floods; later the techniques were further fine-tuned though research projects of several organizations; today it is widely practiced.

Hazard context: River flood, cyclones, saline water intrusion.

Description: River flooding in low lying plains is a common future in coastal areas of Bangladesh. The region is regularly affected by widespread localized inundation due to flood waters, heavy rainfall and cyclonic storms, and the abundance of water hyacinth in the existing water bodies, which hampers water flow and often causes further inundation during flooding periods. Using the water hyacinth and locally available small bamboo sticks rafts are constructed, which have the capacity to float due to their limited weight (CDP, 2004). The floating raft is covered with a layer (10 - 15 cm) of soil mixed with decomposed animal manure, which provides necessary nutrients to the vegetables. Vegetable seeds or seedlings are planted directly on the floating raft. Short duration vegetables and greens are highly suitable for this purpose. The planting beds serve for one season only. Thereafter soil and water hyacinth is used as organic fertilizer. New rafts need to be built for the next season, usually re-using the bamboo sticks.

Suitability: The practice is suitable for low lying frequently flooded areas like coastal Bangladesh. The suitability of the practice for fresh water eco-systems has been evaluated extensively and is confirmed. However, its suitability under salt water inundation was not evaluated. The practice has the potential for adaptation to other areas where flood and periodical water stagnation is an issue.

Possible beneficiaries: This practice is often adopted by small farmers, but is of particular relevance for land less laborers.

Cost estimate: The resources required to implement this practice are water hyacinth and bamboo sticks to construct floating rafts. The floating rafts can be constructed with locally available materials.

Implementation: The practice could be implemented during flood season in the small and medium scale water bodies. However, it has limitations in moving waters of the large rivers where the raft may drift off.

Maintenance: The rafts do not induce any maintenance costs. However they need to be re-built after each season.

Benefits: This practice provides food and income opportunities during flood season. The harvested from the floating gardens may yield up to 10 to 15 kg of vegetables; excess vegetables to home demands can be sold in the market. It engages women and contributes to more nutritionally balanced diet for the households.

Institutional support: Extension support is recommended to reach out to most marginal groups and poor household's women. Agricultural extension departments at the community level need to assist with adequate seeds of flood tolerant vegetables.

4.9 Community weather observation systems

Place: Rain fed uplands in Peninsular India.

Historical perspective: Traditionally farmers monitor rainfall and other weather parameters based on their indigenous knowledge on weather. The unit of measurement is very much localized and location specific. These measurements usually gave an idea about rainfall patterns, but they lacked exact quantification. Nowadays, many farmers in semi-arid India have established their own weather observation systems using manual rain gauges, thermometers and wind anemometers to plan their farming activities.

Hazard: Drought, floods, wind storms

Description: Semi-arid tropics in India are prone to droughts due to highly variable and low rainfall amounts. Traditionally farmers rely on their own indigenous knowledge to make cropping plans based on the rainfall pattern and other meteorological parameters. However, this knowledge and traditional stone pot rain gauges are not sufficient to provide adequate knowledge for planning. To overcome this, local communities have established manual meteorological instruments to record daily weather. Usually the community observatories are established in a common land to facilitate easy sharing of information. Local institutions provide technical support. The local weather observations are interpreted by the farmers in combination with the localized weather and climate forecasts to take up appropriate farm decisions (Selvaraju and George, 2002).

Suitability: The community level weather stations are suitable for all types of farming systems irrespective of farm size. Especially useful are they for areas prone to drought, localized floods and wind storms.

Possible beneficiaries: The local farmers are the major beneficiaries. The localized observations can be used to plan community level disaster preparedness actions and contingency crop planning.

Cost estimate: The total cost for establishing a community based weather station is US$ 400. Weather stations with minimum instruments like manual rain gauges, thermometers and wind anemometers cost even less.

Implementation: The instruments should be built up in open areas with sufficient protection from water stagnation. The weather stations need to be established in open areas.

Maintenance: Periodical maintenance of instruments is required. Local manufactures need to be involved in maintenance.

Benefits: The community weather stations are useful to plan farm activities based on the anticipated climate extremes. The long-term records are useful to take up contingency plans.

Institutional support: Institutional support is required for installation and maintenance of instruments. Capacity building activities are required to improve the monitoring and record of weather parameters by the farmers and local community.

4.10 Climate Field School

Place: Low land and upland rice systems in West Java, Indonesia.

Historical perspective: Integrated pest management field schools are one of the technology transfer and capacity building mechanisms within FAO's development works for many years. The department of agricultural extension in West Java, Indonesia has converted the integrated pest management schools into climate field schools for the benefit of the farmers. The conversion took place to incorporate climate information within the farm decision making process.

Hazard: Drought and flood.

Description: Climate Field Schools for farmers are introduced to improve the basic knowledge of the farmers on climate forecast use in designing crop management strategies (ADPC, 2005). The concept of climate field schools follows the farmers' field school concept. Materials for the field school were mostly developed with farmers based on their experiences. This is intended to familiarize the participants to the process of learning by practice. Thus, climate field schools are a continuous process with discussions, sharing and analyzing experiences, making conclusion, and taking action and then acquire renewed experiences from the actions taken. All processes are facilitated by field facilitators, such as extension workers and farmer leaders. The development of a module requires good understanding on climate information application, and good knowledge of the agriculture system and climate related problems in the site. This will enable module developers to provide example of simulations in the modules that are relevant to the site condition or farmers' problems. The objective of climate field schools is to form farmer groups that have strong motivation to develop their own agribusiness activities where climate information is used as inputs for making plans, strategies and taking decisions. The feed back survey from the farmers in Indonesia indicates strong motivation to use the climate information and participants agreed that the schools improved their knowledge on risk management.

Suitability: The climate field schools can be modified based on the requirement and implemented in various farming systems to reduce the impact of natural disasters driven by climate variability.

Possible beneficiaries: The primary beneficiaries of the field schools are local resource poor farmers, extension workers and decision makers at decentralized levels. The approach is also useful for community based disaster risk management.

Cost estimate: The climate field schools need to be integrated into the existing integrated pest management schools advocated elsewhere and there are no additional costs involved.

Implementation: The climate field schools need to be implemented by the agricultural extension departments at local levels in collaboration with the national or provincial weather bureau.

Maintenance: Sustainability of climate field schools depends on involvement of local beneficiaries, intermediate organizations and policy makers. To reduce the cost of implementation, the approach has to be mainstreamed within the existing risk management programmes.

Benefits: Sustainability of climate field schools depend on involvement of local beneficiaries, intermediate organizations and policy makers. To reduce the cost of implementation, the programme has to be mainstreamed within the existing risk management programmes.

Institutional support: Institutional support is required to implement the programme with the local community to mobilize the resources for capacity building activities and organizing interactive participatory sessions.

4.11 Extended forecasting systems for disaster preparedness

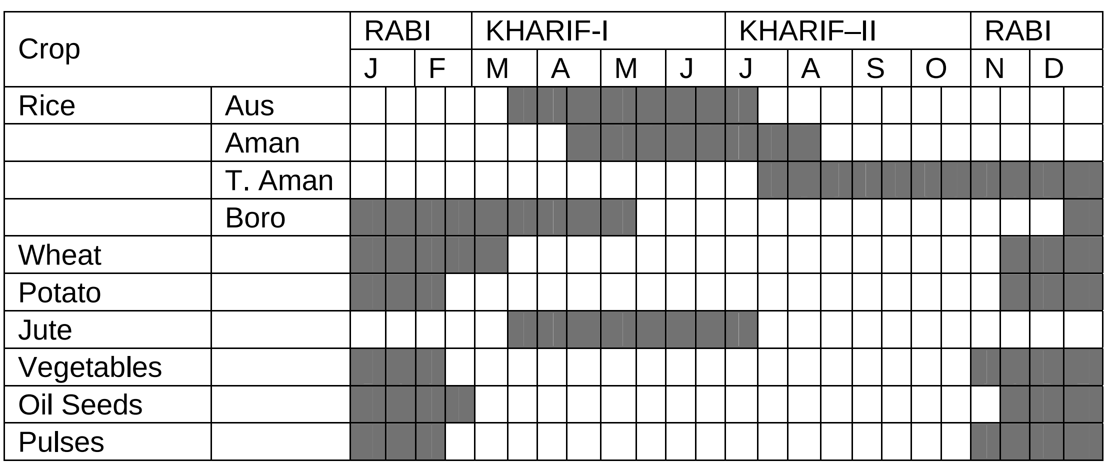
Place: Example from Bangladesh.

Historical perspective: Crop intensification started in the 1960s after introduction of high yielding varieties in many countries in Asia. Mono-cropped areas have been converted into multi-cropped area, with cropping intensities varying from 100 to 300%. Rice became the major crop of irrigated agriculture in all seasons (Fig.5) forcing people to consume only cereal based diets and leading to nutrition deficiencies.

Continuous wet culture has aggravated the already declining crop productivity. Mono cropping has led to over exploitation of resources and reduced availability of secondary and micro nutrients. Organic matter has declined significantly due to replacement of traditional legume, green manure and pulses. Severe pest and disease attack was also noticed in mono-cropped areas.

In Bangladesh, Agricultural crops are being grown during three distinct crop seasons. The seasons are kharif-I (March 15 - June 30), kharif-II (July - September/October) and winter (November - February). Rice is the main staple food crop of Bangladesh grown in about 10 million hectares. In flood years, the crop suffers from inundation during vegetative (early flood), flowering (mid-flood) and maturity (late flood) stages. In dry years, this crop suffers from high yield reduction due to inadequate rainfall (drought) during transplanting period as well as during critical growing period. Crop intensification in general has increased the disaster risks (Fig. 6).

Fig 5: Schematic of dominant crops and cropping systems in Bangladesh (illustrative example)



Description: Enhanced climate forecast application to improve food security

To manage growing risks of yield loss due to disasters, a three tier climate forecasting system is being introduced to provide locally usable information. User needs from the local communities were assessed and the decision calendars prepared to facilitate pro-active decision making at the field level by the farmers (FAO, 2005).

Fig 6: Climate related disaster calendar for flood and drought prone areas of Bangladesh

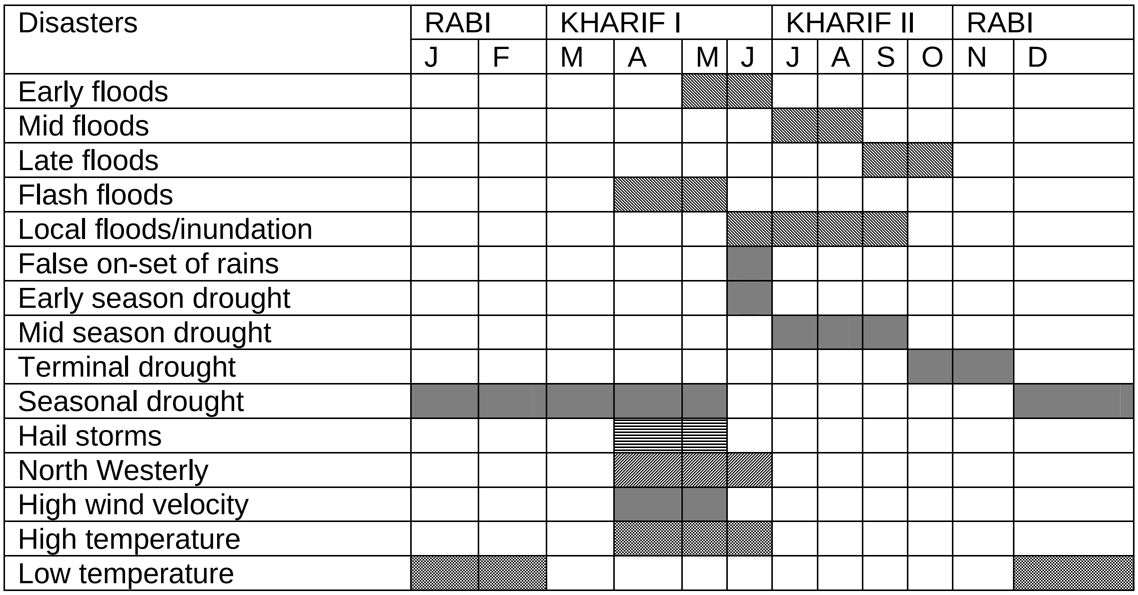


Table 2: Three tier forecasting system, lead time and type of application in Bangladesh

Forecast	Lead time	Nature of decisions
Seasonal	1-6 months	Strategic
Intra-seasonal	20-30 days	Strategic and tactical
Short-term	1-10 days	Tactical

Seasonal climate forecasts will provide general expectation of the rainy season. The agricultural activities are determined by the length of growing period and actual arrival of adequate rains. Start of the rainy season is critical and provides the first indication of the situation about the season. The analysis of the timing of the start of the rainy season and the temporal and spatial variation will highlight areas of early, timely or late onset of growing season rains. Early or timely start of rains will indicate planting of normal crops, while late arrival of rain leads to change in cropping pattern.

Understanding user needs: User need assessment is a preliminary step for weather and climate forecast applications. The user need helps to address the localized timely forecasts that can help the farmers to change their management practices in advance to make any pro-active management decisions at farm level aimed at risk/opportunity management. For examples, farmers require the following information to manage their food production systems.

The date of the start of the rainy season in order to facilitate species selection, identifying zones at risk, etc.

- The date of the end of rains in order to make decisions concerning storage and drying of crops.
- Chances of flooding (early, mid or late floods).
- Droughts during periods of crop development.
- Distribution of precipitation by decade, month, and season.
- Storm intensity that causes soil erosion.

It is also necessary to establish multi-disciplinary working groups for the elaboration of agricultural strategies. They need good understanding of climatology and an understanding of spatial and temporal climate variability. For the diffusion of information products, climate information must be provided in a simple, easily comprehensible format, to agriculturists, food security personals and decision makers.

Communicating climate forecast information: The effective use of climate and flood forecasts in food production systems requires:

- That the right audience receives and correctly interprets the right information at the right time.
- That the information should be relevant to a decision leading to disaster preparedness in agriculture.
- That the forecast information should be supplemented with impact outlooks and disaster management plan.

The criteria for effective communication of climate and flood forecasts are that (i) the forecast products should contain relevant information that are important to the user community (local extension officers and farmers); and (ii) they should also inform about the possible impact of disasters and potential loss/gain of disaster preparedness measures. The development of a "user metric" can help to translate probabilistic forecasts into assessment of aggregate risk due to use of forecasts. User metric is a method by which the value of probable outcome by applying forecasts can be quantified. The user metric should contain the following components:

1. Probabilistic forecasts.
2. Impacts of a climate related event (e.g. flood) in agriculture.
3. Aggregate risk analysis for each outcome.

The user metric with above components offers a way to apply climate and flood forecasts for disaster preparedness in agriculture. However, a challenge remains in interpreting and transmitting climate information from meteorological agencies to end users. An end-to-end framework of forecast application can address the issue of household food security. The end-to-end forecast generation, dissemination and feed back involves the sequential steps as follows:

1. Providing climate outlooks.
2. Interpreting global climate outlook into local outlook.
3. Translating local climate outlook into impact scenarios.
4. Preparation of locally relevant management plans to manage the anticipated impacts.
5. Communication of climate information to farmers and receiving responses/feedback.

As the Caribbean region is also frequently affected by hydro-meteorological disasters, the principles of climate forecast application can be used for disaster preparedness.

5. Conclusion

In the recent past, most Asian countries have greatly improved their capacities to monitor hazards and to warn, evaluate and provide emergency relief to victims of disasters. As a result, the number of lives lost to disasters such as floods, storms and extreme temperature has decreased significantly. However, the vulnerability within the agriculture sector has continuously increased due to its high level of exposure.

It is essential to re-align all disaster management programmes in the agriculture sectors from response to prevention and preparedness. It means in effect, to shift from the current focus on relief and mitigation activities to all-round early warning, prevention, preparedness, relief, rehabilitation and sustainable recovery activities. It is also required to integrate disaster prevention within the agricultural development processes. There are many examples of farmer's led participatory disaster risk management initiatives at pilot scale in Asia. However, efforts are required at much greater scale to mainstream these pilot scale efforts at the national and regional levels. Although disaster risk reduction is now widely adopted, it still remains a challenge to fully integrate it into agriculture sector development planning.

To make a difference, it is essential to mobilize sufficient resources to implement action plans effectively within the agriculture sector. In some low-income developing economies, governments find it difficult even to meet regular expenditures. Others can only put resources together for marginal development activity. Under such unfavorable circumstances, securing investment funds for disaster prevention and preparedness will be hard. It is important that we recognize this difficulty and seek cost effective ways and means to learn from other similar regions and exchange the good practices for possible adoption. Better agricultural development planning, higher private sector investment, and more farmers' participation can contribute to the shifting from relief and response to preparedness and mitigation. Adaptation of locally relevant 'good practices' to mitigate the impact of disasters through evaluation, demonstration and monitoring would yield greater benefits under resource poor farming conditions irrespective of regions.

A major weakness at present, irrespective of region, is the lack of operationally functioning comprehensive approaches to disaster risk reduction. Further, DRM has not yet been integrally incorporated into the agriculture sectors. These strategic deficiencies have significantly reduced the resilience of the sector and of local communities to cope with hydro-meteorological hazards such as Hurricane Ivan, which devastated the Caribbean region in 2004. In recognition of the immense negative impact of disasters, there is an urgent need to understand the good practices locally evolved for centuries and promote widespread demonstration and dissemination among the farming communities. Despite understanding the local good practices, the practices followed in similar agro-ecological regions can be adopted, fine-tuned and implemented. This inter-regional technology transfer and exchange of good practices, once led to implementation, could reduce significantly the resource requirements for the development of new good-practices specific to a certain region.

Looking at the rainfall pattern and type of hydro-meteorological disasters in the Caribbean region, there are similarities in-terms of severity and impact noticed with the Asian region. For instance, the low rainfall upland areas of Haiti are similar to the semi-arid regions in southern peninsular India in terms of rainfall pattern and crops grown. The similarities offer enormous scope for inter-regional exchange of good practices relevant to disaster risk management in agriculture sector. The good practice examples provided in this report may help to stimulate the needed exchange of knowledge and lessons and promote the replication and adaptation in one of the project countries of one or some of the practices which proofed successful in the Asia hazard risk context.

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