

# Enhancement of Rainwater Storage Capacities Using Rice Paddies

## Mitsuke City



### Background and Purpose of Project

Mitsuke City suffered heavy damage from the 2004 July 13 water disaster which caused levee breaches at a state-administered Class A major river.

After that, improvement work and other measures were carried out as prefectural projects for the river that caused the major disaster. But such work was delayed for the city's urban areas and another Class A river, into which water from 1,200 hectares of rice paddies flowed.

In order to reduce the burden on rivers during heavy rain, lessen the amount of water released from rice paddies on the riverfront, and protect local areas from massive water damage, a project to build rice paddy dams was initiated.

Water outlets were replaced with smaller ones to enhance the water retaining function of rice paddies. The measure was designed to reduce the amount of water released from rice paddies in times of heavy rain, ease the burden on rivers, and reduce damage from massive quantities of water on farmland and urban areas on the riverfront.

### Outline of Project

2,700 units of adjustment pipes (Mitsuke Model new adjustment pipes) were installed into rice paddy water outlets.

The new pipes had an internal funnel-shaped structure with a smaller opening (5 centimetres in diameter) at the bottom. They were fitted into ex-

isting drain pipes (15 centimetres in diameter). Because of the new pipes, it takes more time to release water stored in rice paddies during heavy rain and the amount of water released into drain channels and rivers is reduced.

A research team of Niigata University Faculty of Agriculture members carried out the analysis in fiscal 2012 in a project managed by the prefecture.

To maintain and manage the new pipes properly, a commission fee of 500 yen per pipe is paid to all participating agricultural producers from fiscal 2015, with necessary confirmations made by the association.



New adjustment to pipe

### Features and Advanced Aspects

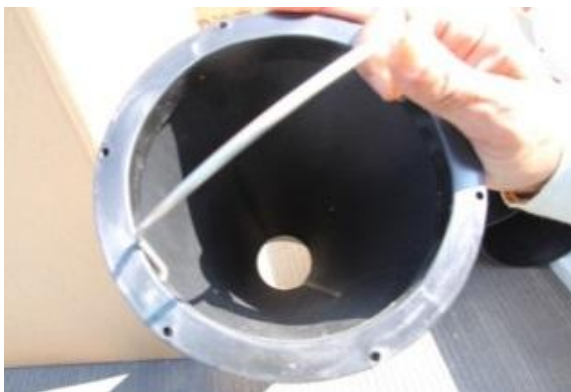
This initiative to utilise the water storage capacities of rice paddies, has spread to other parts of Niigata Prefecture since fiscal 2002 and to other places across Japan year by year. Among various projects in Niigata Prefecture, Mitsuke's is

considered the most advanced and the city has received inspections by officials from many parts of the country.

A key reason for this is that Mitsuke's project was implemented by the city and promoted in cooperation with agricultural producers' organisations, while many other projects are subsidised ones that are implemented by producers.

The project is different from others also in that its effectiveness has been demonstrated through an analysis carried out in collaboration with a university.

The project has been shown to be highly effective, with Mitsuke's newly introduced adjustment pipes confirmed as capable of reducing by 80% the amounts of water released at peak times during heavy rain. Simulations based on a past natural disasters confirmed the effectiveness of the pipes



Mitsuke Model New Adjustment

in substantially reducing disaster damage.

### **Effects of Project**

The effectiveness of the project is usually analysed through simulations, because it is difficult to compare the situations before and after the project, given the project's inherent characteristics. The result of an analysis of the project's effectiveness by a Niigata University research group in fiscal 2011 is as follows:

#### Rain Conditions

- Total rainfall of 231 Millimetres
- Maximum 24-Hour rainfall of 167 Millimetres
- Maximum hourly rainfall of 45 Millimetres

#### Effects Shown in Analysis

- 100% implementation of rice paddy dams reduces area of inundation up to ground level in urban districts by 93%
- 100% implementation of rice paddy dams reduces area of Inundation above ground level in urban districts by 100%

### **Problems and Responses**

#### **◆Before Project Implementation**

This project required the consent of agricultural producers as it involved rice paddies that they owned. It was impossible to obtain approvals individually because the project covered a wide area and the number of producers concerned reached nearly 1,000.

So the city worked with the farmland facility maintenance and management association, a group set up by community-elected representatives of agricultural producers for the maintenance and management of local farmland facilities. The city formed a consensus this way and started work to launch the project.

#### **◆After Start of Project**

The water-level adjustment pipes installed at rice paddies at the initial stage of the project, unlike the new ones, were cylinder-shaped pipes with a 6-centimeter hole on each of two sides. The pipes were inserted into water outlets from the top and could be slid up and down to adjust their positions. Usually, water from rice paddies was drained through the side holes. During heavy rain, water exceeding the holes' draining capacities was held in rice paddies. When the water quantity increased further, water was released through the hole at the top of the water-level adjustment pipes.

But agricultural producers were left to adjust the positions of water-level adjustment pipes manually for release amount control. Due to this system, rice paddy dams did not function well enough in some cases.

So, the Niigata University research team and Mitsuke jointly developed the "Mitsuke Model new adjustment pipes," which fully serve their intended functions at any time without being influenced by adjustments by agricultural producers. In the district covered by the project, all of the old pipes were replaced with the new ones and the new version was introduced where no old pipes had been installed yet.

## **Outlook**

In order to promote rice paddy dams in an effective manner using the Mitsuke Model new adjustment pipes, it will be necessary to check the conditions of the pipes, water channels and ridges between rice paddies throughout the year.

## **Reference URL**

<http://www.city.mitsuke.niigata.jp/6568.htm>

\*Japanese

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# Simulation of Water Release from Rice Paddies during Heavy Rain

Rainfall Scenario: Nagaoka City 30-Year Probability Rainfall Event with Anticipated Daily Rainfall of 226 Millimeters

Rainfall Curve: Late Peak Type ( $r=0.8$ )

