

Winter-flooded Rice Paddies Nurture Biodiversity and Restore the Natural Environment of *Satoyama*

ふゆみずたんぼ絵こよみ

Late Autumn
晩秋

chironomidae
tubificidae worm

Winter

Spring

Summer

Autumn

Illustrated Calendar of Winter-flooded Rice Farming

Filling rice paddies with water creates "oases" for many organisms such as small fungi, chironomidae, tubificidae worms, and waterbirds. In particular, bird feces make good fertilizer. Algal blooms in spring, also turn into a natural fertilizer.

● Dead fish and tadpoles turn into natural fertilizer.

Water Management during winter

● Increase of microbial biodiversity/activity.

● Japanese red frog spawning season from late February to March. No spawning is possible without water in the rice paddy.

Decomposed rice straw

No Agricultural Chemicals, No Chemical Fertilizers
Preparing Rice Seedlings for Winter-flooded Rice Paddies

二月 February			三月 March			四月 April		
early	middle	late	early	middle	late	early	middle	late
Selecting seeds with salt water			浸種開始 Seed soaking starts			40日程度 About 40 days		
Hot water sterilization			浸種終了 Seed soaking ends			準備完了 Preparation for seeding pool		
● Selecting Seeds in Salt Water Selecting large and heavy seeds with less space between chaff and seed in salt water.			● Hot Water Sterilization Sterilize seeds with hot water to prevent rice blast, brown spot, and bakanae, (foolish seedling) disease.			● Sowing The number of seeds sown should be a half or less than that of conventional farming. Pol-cultures are easy to prepare and suitable for organic farming.		

Fertilizing Effects

Water Birds and Preferred Water Depth

Source: Fredrickson and Dugger, 1993 and Fredrickson and Reid, 1996.

Integrated Biodiversity Management (IBM)

Effect on Weed Control

Control of Cadmium Absorption

Heavy metals such as Cadmium in the soil are absorbed least to rice crops under low oxygen, a state of reduction by keeping water in rice paddy. A combination of the following measures is considered effective to prevent their absorption:

- No drainage for three weeks before and after heading
- Delay the timing of drainage
- Winter-flooding

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■ Frogs and Spiders Eat Insect Pests

What's the role of frogs and spiders in rice paddies? Previous studies indicate that spiders and frogs feed on insect pests. Surveys show that number of spiders and frogs were higher in winter-flooded rice paddies than in conventional rice paddies. The Integrated Biodiversity Management (IBM) recommendations received much attention recently, by suggesting natural control of pests as part of ecosystem management (Kiritani, 2004).

■ Tubificidae and Other Worms Overlay the Fine Soil-like Toro-Toro Layer

Winter-flooded Rice Paddies promote growth of tubificidae worms. When the density of the worms reaches 2/cm², weed seeds sink into the fine soil-like layer of their feces (Kurikahra 1983). The fine soil particles that pass through the body of worms mix with fungi forming the *toro-toro* layer. This depresses weed seeds ~ 10cm/ year and thus prevents their germination.

Give-and-Take Relationships between Rice Paddies and Migratory Birds

White-fronted Goose: a flagship species

The white-fronted Goose is a typical winter migratory bird that breeds in tundra of arctic Russia in summer. In autumn, they travel about 4,000 km south to Miyagi Prefecture, Japan. It is a large bird with a wingspan of about 160 cm.

It used to be found all over Japan, but its number and habitats have decreased due to over-hunting and land development. Since legal protection took effect in 1971, the number has increased to over 100,000. Suitable habitats, however, remain few. It needs a wide, safe area of water and rice paddies for overwintering. It is thus a symbol of rich biodiversity. Most of the population now overwinter in northern Miyagi, where such habitats still exist.

Relationship between the White-fronted Goose (a flagship species) and Rice Paddy

The White-fronted Goose was threatened with extinction and designated a protected species in 1971. Although its number has been increasing, its major habitats are still limited to the northern part of Miyagi Prefecture. It requires a wide, shallow body of water for roosting at night and rice paddies as feeding sites. Feeding sites are usually located within a radius of about 10 km from the roosting site. If this species uses winter-flooded rice paddies as new roosting sites, the rice paddies around there become new habitats for the geese to spread their distribution. Rice paddies are classified as one type of important wetlands under the Ramsar Convention. Rice Paddy Resolution X.31, proposed by Japan and Korea at Ramsar COP10, 2008, recognized the biodiversity of rice paddies. At CBD COP10, 2010, a similar decision (X.34) was also adopted.

Winter-flooded Rice Paddies Q & A

Q: How to secure a water source during winter?
A: Use diverted river water, shallow wells, mountain streams, or irrigation. Use an electric pump or gravity to channel the water. Plug under drainage and repair ridges between paddies to prevent leakage.

Q: Will winter flooding the paddy cause inconvenience in the spring?
A: It depends on soil quality and farming method; however, our research shows that soil returns to normal about one month after drainage. It should cause no major problems if the drainage timing is set according to soil type. When paddies get too swampy, they can be temporarily dried while continuing winter-flooding long term.