



Fertilizing the fields with ducks, Japan

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Short title: Fertilizing the fields with ducks, Japan

Key Message: Combining different agricultural organic production schemes in a smart way cannot only save money that was previously spent on buying chemicals, but also helps diversify the food production, gain higher incomes and conserve biodiversity as well as improve the supply of ecosystem services.

Reviewer: Takashi Hayashi

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What was the problem?



Aigamo ducks swimming in a rice field (JIN 2002)

Experts and practitioners across Asia have for a long time reflected the application and often overuse of chemical fertilizers, herbicides and pesticides. Scepticism about the outcomes of agricultural practices that use these chemical inputs grew over time, because of the high costs for chemical products and the perceived negative effects of artificial chemicals for the environment. The pesticides seemed, for instance, not to prevent the appearance of nasty insects, and their stings were causing even more trouble (Xu 2006). Thus, considering the farmers' and consumers' health motivated scientists and practitioners to look for alternative methods (Xu 2006). Organic farming was an option but in its traditional understanding very labour intensive. Arata Seiko, Okita Toshio and Furuno Takao are commonly considered the pioneers of the so called *Aigamo* method, i.e. weeding with ducks and fertilizing the fields with the ducks' faeces and adding to the productivity of the system through the introduction of fish. In Japanese literature, however, many authors trace the roots of this method back to World War II. Some even see its early stages in the Heian era (9th to 12th century). This method saves labour and costs for artificial inputs. The *Aigamo*-duck is a crossbreed of the *kamo* (wild duck) and the *ahiru* (domestic duck). *Aigamo*-ducks produce a lot of tasty meat and are easier to obtain and to deal with than the *ahiru*- or *kamo*-ducks. Mr. Furuno and other institutions have promoted this method for more than 30 years (Ho 1999).

What was done to solve it?

The method works in the following way (Ho 1999; Xu 2006): Two-week-old *Aigamo* ducklings are introduced into a rice paddy about one or two weeks after the seedlings have been planted. The number of ducklings can vary. Different sources mention numbers

between 100 and 400 per hectare (Xu 2006). A shelter is needed where the ducklings can rest. The field should provide protection for the ducks from dogs, cats, weasels, raptors etc. The ducks are left in the fields all the time, where they can range completely free. The situation changes once the rice plants form ears of grain. Then the ducks have to be taken away to prevent them from eating the rice grains. They have then to be fed to mature and lay eggs. Waste grain is an option. In addition to putting ducklings on the paddy-fields, an aquatic fern (*Azolla microphylla*) is introduced which grows on the surface of the water. The azolla fixes nitrogen and serves as duck feed. The plant also provides shelter for the fish (i.e. roach) which can also be introduced and which feed on duck faeces, daphnia and worms. The fish and ducks provide manure to fertilize the rice plants and stimulate through the turbulences they cause when moving the plants to grow stronger stems. The rice plants are thus not only less vulnerable to storm but in turn provide shelter for the ducks and fish.

Scientific analyses show that this system has a positive effect on the improvement of soil fertility and the conservation of the biodiversity for instance of the diversity (not the number) of arthropod communities (Hossain et al. 2005; Quin 2011; Tojo 2007).

Comparing the traditional organic farming methods where the fields are manually weeded, the Aigamo method can save as much as 240 person-hours per hectare every year (Ho 1999). A lot of studies in different countries and under different socio-economic settings have shown other economic advantages. One example from Japan shall serve here as illustration (see table 1). Table 1 shows that rice yield in the different systems was more or less the same, but due to higher prices for the 'Aigamo rice' and to the additional income from the ducks the profit was nearly double of the conventional system. It also shows that some of the ducklings died due to sickness, predators etc.

Method	Conventional	Aigamo
Crop area (m ²)	8,000	7,800
Ducklings per ha	0	170
Duck survival	--	81
Rice yield (kg per ha)	4,500	4,150
Gross income (1000 Yen) per ha	125.6	195,3
Income from ducks (meat, eggs)	--	13,8
Profit (1000 Yen)	75	134,2

Table 1: Comparison of the economic incomes of the Japanese rice farmers with Aigamo method and conventional method (with reduced chemical use) – 1998 (adapted from Xu 2006: 89)

Mr. Furuno himself gains with his 3.2 hectare farm an income of approximately US\$ 160,000 per year from producing rice, organic vegetables, eggs and ducklings (Schwab Foundation).

The introduction of Aigamo-ducks and fish tackle various aspects:

- It saves costs for chemical inputs through the fertilization through ducks.
- It saves labor for the weeding which was usually done manually or through herbicides
- It helps control pests (insects, snails etc.)
- It stabilizes ecosystems (more resistant (diseases and weather hazards) rice plants, higher biodiversity etc.)
- It raises income from rice and adds through the sale of eggs, meat and fish.

This said it also should be mentioned that the Aigamo method is still not widespread in Japan. Most conventional rice farmers, for instance, are concerned that the method is risky and too sensitive to the specific local conditions (with regard to weeding and insects) and technical aspects (especially the question when and how farmers release what number of

ducks). Finding the right balance requires some luck and experience. Following false tracks, on the other hand, can affect the income of farmers to a large extent.

Which ecosystem services were examined? And how?

A number of ecosystem services were addressed through this production method. Provisioning ecosystem services (food), regulating services (effects on climate, less vulnerable to weather hazards), cultural services (aesthetic and philosophical / spiritual values) as well as to a certain extent supporting services with regard to the improvement of soil fertility and the conservation of the diversity.

What policy uptake resulted from examining the ecosystem services?

After demonstrating that small-scale organic farming can be highly productive, Mr. Furuno disseminated his ideas through books and lectures. An estimated 10,000 farmers have taken up the Aigamo-method in Japan alone (Ho 1999). Through his writing, travels, lectures and cooperation with agricultural organizations and governments, an estimated number of 75,000 farmers use the method in Japan, South Korea, Vietnam, the Philippines, Laos, Cambodia, Malaysia, China, Taiwan, India, Cuba and Bangladesh (Schwab Foundation). Farmers have increased their yield by 20 to 50 per cent or more in the first year. One farmer in Laos increased his income three-fold (Ho 1999).

Lessons learnt

Combining different agricultural organic production schemes in a smart way cannot only save money for buying chemical inputs, but also helps diversify food production, gain higher incomes and conserve biodiversity, as well as improve the supply of ecosystem services. Farmers can introduce their knowledge and experience in innovative production systems and can be a source of sustainable solutions to pressing questions like the food security of future generations.

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