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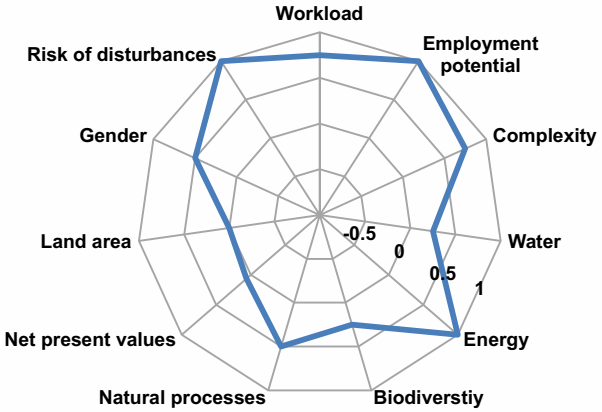
Integrated Rice-duck Farming

Technology fact sheet | 14 / March 2015

Key facts

- Ducks reduce pests and weeds in rice fields and provide nutrients to rice plants.
- The use of agrochemicals can be reduced, thus lowering production costs.
- Rice yields increase by up to 20 per cent, resulting in 50 per cent higher net returns.
- Availability of eggs and duck meat results in improved nutrition and/or additional income.



This graph summarizes the results of a sustainability assessment conducted for this technology. The closer the line is to the outer edge of the diagram, the better the technology performs in terms of the particular criterion.

What is integrated rice-duck farming?

- Integrated rice-duck farming makes use of the mutually beneficial relation between ducks and the rice crop to increase rice productivity.
- Ducklings are allowed to forage in the paddy 10-15 days after rice transplanting until the flowering stage about two months later.
- The foraging ducks 1) remove weeds, 2) eat pests, 3) soften the soil with their bill and feet, thereby releasing trapped nutrients and 4) produce natural fertilizer with their droppings.
- The use of agrochemicals can be reduced and rice can even be cultivated without agrochemicals.
- Integrated rice-duck production is a low-cost, organic farming method for small entrepreneurs.

History

- Rice-duck farming is a 500-year-old tradition in Japan, where it is called the 'Aigamo-Method'.
- The traditional method was re-engineered by a Japanese farmer, Mr. Takao Furuno, into a modern system of organic farming.
- In Indonesia, the technology was introduced by the Indonesian Agency for Agricultural Research and Development (IAARD), Assessment Institute for Agricultural Technology (AIAT) of the Ministry of Agriculture, in districts of Central Java.
- In Bangladesh, the technology was pioneered jointly by the Bangladesh Rice Research Institute (BRRI) and the non-governmental organization (NGO), Friends in Village Development in Bangladesh (FIVDB), through field research based on an idea obtained from Japan. Field research on integrated rice-duck farming started in Bangladesh in July 2001 for a three-year period. Since 2006, the NGO is providing training and extension services for integrated rice-duck farming.

Where it works

- The technology works well in typical lowland rice growing areas like in the north-east of Bangladesh having flood plains and relatively high annual rainfall of 4,000-5,000 mm. The area has clayey and loamy, non-calcareous grey soils.
- The technology is adopted by farmers with knowledge of rice production and duck rearing. The majority (95 per cent) of the adopters or their families in Bangladesh were previously involved in rice farming and duck rearing.
- In Bangladesh, just over half (52.5 per cent of the rice-duck farming adopters are women. Nearly two thirds of the adopters are likely to be functionally illiterate.

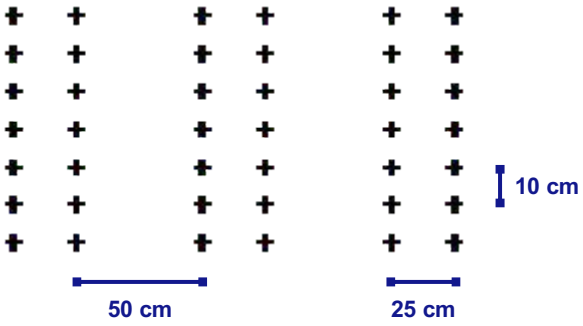
Technological aspects

Crop management

- Flooding the rice field during the initial growth stage is essential for best results with the ducklings. Therefore, the field must be well leveled and all field bunds must be properly constructed. Repeated ploughing before levelling, helps to control weeds at an early stage. FAO TECA (2014) suggests that ducks can forage in the field during the two weeks of field preparation to feed on golden snail which are a rice pest in the Philippines.
- Five tonnes of compost or cow dung are applied per hectare of paddy field.
- Spacing of rice plants should be wider than in traditional systems to facilitate the movement of ducklings between the

rice plants. In Indonesia, the so-called *legowo* row planting system (2:1) with spacing of 25 x 10 x 50 cm (see Figure 1) is used. In the Philippines, a minimum distance of 20 x 20 cm is recommended between rice plants (FAO TECA, 2014). Seedlings that are 21 days old are transplanted, using 2-3 plants per hole. Mr. Furuno transplants at 33 x 27 cm but suggests the optimal transplanting distance should be individually tested (Furuno, 2009).

Figure 1. *Legowo* row planting system 2:1



- An integrated pest management approach is recommended.
- Manual weeding can be performed with *gasrok*, a traditional weeding tool or other manual weeders like the cono-weeder (see Figure 2).

Figure 2. Indonesian *Gasrok* weeder (left) and cono-weeder (right)

Source: Parinatha (2013)

Source: indiastudychannel.com

- Rice harvesting should be conducted on time, when 80-85 per cent of the grains are ripe with a golden yellow color (de la Torre, 2010).

Maintaining ducks in an integrated rice crop field

- Young ducklings are kept and fed in cages heated during the day and night for two weeks.
- Transfer ducks between the ages of two and four weeks into group cages, providing heating only at night.
- Before releasing the ducklings, the rice field must be fenced to avoid ducklings from entering neighbouring fields and to keep natural enemies out of the rice-duck field. Furuno (2009) uses an electric fence to protect against wild dogs, raccoons, rats and weasels, and fishing lines, stretched tight above the field to protect against birds.

Figure 3. Duckling cage with heating lamp

Source: http://www.domesticwaterfowl.co.uk/images/hicks/brooder.jpg

- Group swimming training of four to five days in a small protected field is recommended for very young ducklings (Furuno, 2009). Alternatively, FAO TECA (2014) suggests leaving ducklings between one to three weeks old and with no swimming training, for two to four hours in the field for the first three to five days after their first release. After one week, ducklings can stay in the field from morning to evening but need to return to the shelter at night.
- The establishment of rice roots is key for deciding the right moment to release the ducks in the field. According to FAO TECA (2014), ducks can be released five to seven days after transplanting without damage to the crop. Furuno (2009) observed best weeding results after releasing ducklings 7 to 10 days after transplanting and Hossain *et al*. (2005), released ducklings, 10 days after transplanting rice.
- The water table should be maintained so that the feet of the ducks barely touch the ground (Suh, 2014).

Figure 4. Young woman guiding ducklings to a rice field

- Ducklings should be between one and three weeks old when first released into the field (FAO TECA, 2014). Hossain *et al.* (2005) released them at the age of 20 days.
- Different stocking rates will result in differences in the overall performance of the rice-duck system. Working with 100 ducks/hectare will result in acceptable weed control (Furuno, 2009), but increasing stocking densities to between 150 and 300 ducks/hectare as suggested by Furuno (2009), 375 ducks/hectare as done by Khan *et al.* (2005) and to between 350 and 400 ducklings/hectare as done by Hossain *et al.* (2005), will benefit farmers with improved pest control, nutrient supply, soil muddling and rice stimulation.
- Feed the ducks in the afternoon or evening using: (i) the same feed as broilers (BR1) when ducklings are 1-30 days old and (ii) concentrated mixture of fine bran and corn flour in the ratio 1: 1: 2 when the ducks are 1-3 months old.
- Remove the ducklings from the rice fields just before or at the time of flowering of the rice crop, about two months after transplanting (Khan *et al.*, 2005).

Figure 5. Ducklings moving in an unfenced rice field

Economic aspects

- Rice yields increase by up to 20 per cent, resulting in 50 per cent higher net returns. This is due to the higher yield, reduced production costs and additional income through the sale of eggs and duck meat (Hossain *et al.*, 2005).

Table 1. Yield from rice-duck farming compared to rice-only farms in the Bicol region, Philippines

Location	2nd crop cycle			3rd crop cycle		
	Rice-duck farming		Rice-only farming	Rice-duck farming		Rice-only farming
	Rice (t/ha)	Eggs	Rice (t/ha)	Rice (t/ha)	Eggs	Rice (t/ha)
CamSur	2.7	720	1.8	3.5	280	2.7
Albay	2.7	720	1.8	3.72	309	1.36
Sorsogon	4.5	480	4.0	4.2	275	3.3

Source: FAO TECA (2014)

- In the Indonesian districts of Batang and Brebes, integrated rice-duck farming can increase rice productivity from 3.58 to 5.11 tonnes per hectare.
- Farmers have to invest in ducklings, cages, heating lamps and fencing material, at an initial cost of Tk65,908 ($830) per hectare.
- In Bangladesh, two to three cropping seasons are possible for rice cultivation and rice-duck farming (see Table 2).

Table 2. Returns per hectare from rice-duck and rice-only farming in Bangladesh

Season	Cropping system	Gross value	Variable costs	Gross margin		Gross margin for a year
		Tk	Tk	Tk		Tk
T. aus	Rice-duck	46 800	23 775	23 025	Rice-duck	79 049
	Rice	27 100	15 400	11 700		
T. aman	Rice-duck	53 683	25 669	28 014		
	Rice	35 990	20 255	15 735	Rice	40 515
Boro	Rice-duck	53 340	25 330	28 010		
	Rice	34 980	21 900	13 080		
		$	$	$		$
T. aus	Rice-duck	709	360	349		
	Rice	411	233	177	Rice-duck	1 198
T. aman	Rice-duck	813	389	424		
	Rice	545	307	238	Rice	614
Boro	Rice-duck	808	384	424		
	Rice	530	332	198		

Source: adapted from Hossain *et al.* (2005)
Note: $1 = Tk66 in 2015
Variable costs of rice-duck farming: seeds, land preparation, ducklings, feed, vaccines and post-harvest.
Variable costs of rice-only farming: seeds, fertilizer, land preparation, pesticides, inter-operational and post-harvest. Labour costs are not included.

- A more detailed cost-benefit analysis in Khan *et al.* (2005, Table 12.1, p. 145), confirms the economic benefits of rice-duck farming.
- In Indonesia, rice-duck farmers can increase profits from Rp 3,572,908 ($367)[1] to Rp 9,402,871 ($966) per hectare.

Environmental aspects

- Effective weed control by ducks without the use of herbicides. The continued use of ducks in paddy fields for nine years reduced weed species, density and diversity. Above-ground weed density decreased by 90 per cent (Li *et al.*, 2012).
- Effective pest control by ducks reduces or eliminates pesticide use.
- High water need for lowland paddy irrigation: 1,300-1,500 mm for irrigated rice in Asia; up to 2,000 mm for loamy sandy soil with groundwater tables 1.5 m deep or more (Bouman and Tuong, 2001, cited in Bouman *et al.*, 2007, p. 9).

[1] Currency conversions based on Oanda.com (31.03.2013)

Social aspects

- Two to three household members are involved. Labour-intensiveness was identified as a major challenge to the diffusion of rice-duck farming (Suh, 2014).
- In Bangladesh, 52.5 per cent adopters are female.
- About 200 m^2 of irrigated land is required at least.
- The additional income improves living standards and education prospects for children (Tsurita, 2009).
- Health improvement of adopters because of increased food diversity; reduced incidence of schistosomiasis (Tsurita, 2009).

Issues for replication

- Labour-intensive tasks such as herding and fencing and labour shortage in rural areas (Suh, 2014).
- Positive external effects like reduced land degradation and global warming climate change mitigation should be internalized through appropriate price policies.
- An important reason for discontinuation is the lack of cash for investment.
- Risk of mortality from chronic respiratory diseases (CRD) in adult ducks, paralysis in ducks of all ages, E-Coli in chicks and high mortality of ducks in winter.
- Many adopters report that neighbours initially complain about the technology.
- Ducks may die if water run-off from neighbouring rice fields contains pesticides. A community approach to the adoption of rice-duck farming can avoid this problem.

Contact

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Related topics

- System of Rice Intensification (SRI) fact sheet: http://www.satnetasia.org/database/layout.php?id=26.
- Sand-based Mini-hatcheries for Chickens and Ducks fact sheet: http://www.satnetasia.org/database/layout.php?id=21.

Useful link

https://www.youtube.com/watch?v=SJdelJYJrxI

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