

Alternative Uses of Rice By-Products in Vietnam

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In most countries facing increased population pressure, the exploitation of natural resources becomes more stringent and proper management needs greater emphasis. In Vietnam, two densely populated regions, the Mekong Delta in the south and the Red River Delta in the north, are trying to cope with an increased pressure on natural resources. The creativity of the Vietnamese in finding alternative uses for by-products has stimulated me in writing this paper. In this part, I will concentrate on the country's largest export crop, rice.

During the rice-cropping season, some farmers already make use, whether directly or indirectly, of some unwanted products in their field, namely weeds and insect pests. In Vietnam, weeds serve both as food and animal feed. The waterspinach, *Ipomoea aquatica* is consumed by humans or is offered as green forage to pigs, ducks or chickens. Another aquatic weed, *Monochoria vaginalis*, is favorite green forage for ducks. Likewise, the floating fern, *Pistia stratiotes*, is often supplemented as green forage for pigs and ducks. The idea behind the vernacular name, namely duck weed, can therefore be easily traced back. For pigs, it is often cooked with broken rice, as it can cause throat irritation. Animals also readily consume the annual herb *Ludwigia octovalvis*, while *L. adscendens* is considered a vegetable. Besides, both plants have medicinal applications as for instance against diarrhea. This to name only a few. Once the rice is harvested, ducks or water buffaloes often consume the fallen grains, graze rice stubble and weeds, bringing in organic fertilizers in the field.

Rice pests are turned into an advantageous business in those farming systems where rice is integrated with duck or fish production. Ducklings or fish as the common carp *Cyprinus carpio*, the Thai silver barb *Puntius gonionotus* and the Nile tilapia *Oreochromis nilotica*, amongst others are known to reduce mainly leafhoppers, planthoppers, leafhoppers and stemborers. The rice caseworm *Nymphula depunctalis*, a major pest in the Mekong Delta, is one of the examples in which rice pests are reduced by integrating fish culture. As such, farmers do not only diversify their production and reduce risks due to changing rice prices on the world market, they also directly contribute to a healthier environment by reducing, if not completely banning pesticides.

After harvesting, the grain is separated from the straw. From this stage onwards, many alternative uses compete for the same by-products, depending on regional circumstances. In the Mekong Delta, for instance, rice straw often is an inoculum source for mushroom cultivation. Farmers like to cultivate the mushroom *Volvaria esculenta*, because it requires little management and offers them extra income within a limited time. After harvesting the mushrooms, the straw is further composted and serves as organic fertilizer. In North Vietnam, on the other hand, straw is encouraged to be used as bedding for breeding livestock.

Rice husks, of which nation wide 1.5 million tons are produced annually, are used for making cushions, as an alternative fuel and as a reserve winter fodder for cattle in the north. In the south, it is often mixed and cooked with other waste products and subsequently offered to pigs or fish raised in ponds. For pig's feed, broken rice or refuse of rice wine (rice distiller's by-products) may serve as cheap ingredients.

As industrialization moves on, some more alternatives for the utilization of rice husks have been put forward. Experts have recently proposed to use the husks for processing Aldehyde Furfural, which now has to be imported at great cost, in order to extract and subsequently refine oil. Other proposals are to burn the husks. The ashes then serve as an additive to produce light concrete capable of carrying heavy loads.

No matter which way the allocation of these resources evolve, attention will have to be paid to the fact that organic matter remains a factor of utmost importance in sustainable agriculture. Soils under agricultural production need enough organic matter. Without this, even the largest amount of chemical fertilizer applied, will give little or no effect on agricultural production, on the contrary, it will contribute to pollution.

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