

Organic Rice Cultivation with Biodiversity and material circulation; Main technical points (the meaning of SRI Method modified in Japanese way.)

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- ① Organic Rice Cultivation with Biodiversity
- ② Material Circulation at low cost and low labor input with cycle cultivation of rice·wheat·soybeans product



NPO Civil Institute of Organic Rice Cultivation

” Biodiversity Organic Rice Cultivation” for Low-Cost and Labor-saving Cultivation —One seedling planted by a pot rice transplanter—



Pot 1 seed sowing machine



Pool nursery



5.5 leaf-age : Pot 1 seedling
Till it to three (40th)



30 days before rice planting,
basal fertilizer 30 kg spraying:
1st Padilling and flood management



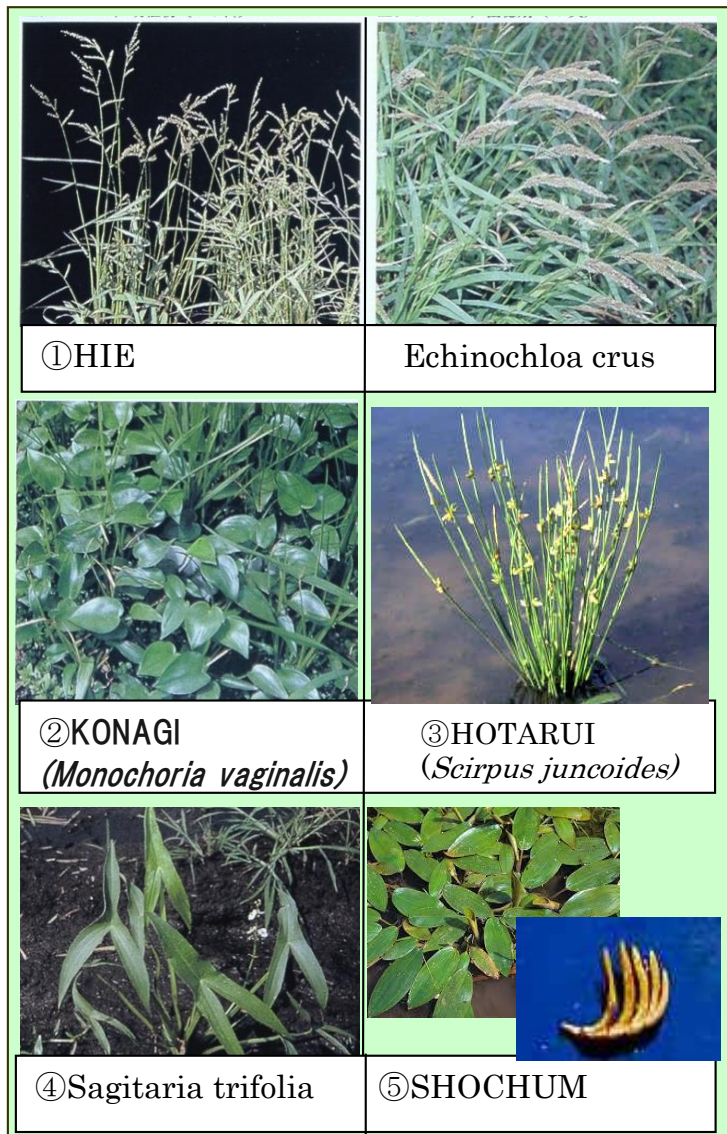
Transplant three days after the second padding
5.5 leaf-old seedlings Plant only one



Maintain water level 7 cm or more for 30
days from immediately after planting rice,
suppressing the occurrence of weeds

Basics of Weed Control Methods with Biodiversity

Categoryze Harmful Weeds in Paddy Field into 4 Types.



【Annual weeds (Multiply through seeds)】

- **Wetland weeds** like **HIE**(*Echinochloa crusgalli*) can not germinate & grow **without oxygen!** They germinate at 14°C.
- **Aquatic weeds** like **KONAGI** (*Monochoria vaginalis*) germinate **from the seeds at the surface of soil within 10mm depth. Germinate at 20°C earth temperature.** High sencitivity to light; Can not germinate & grow without light.

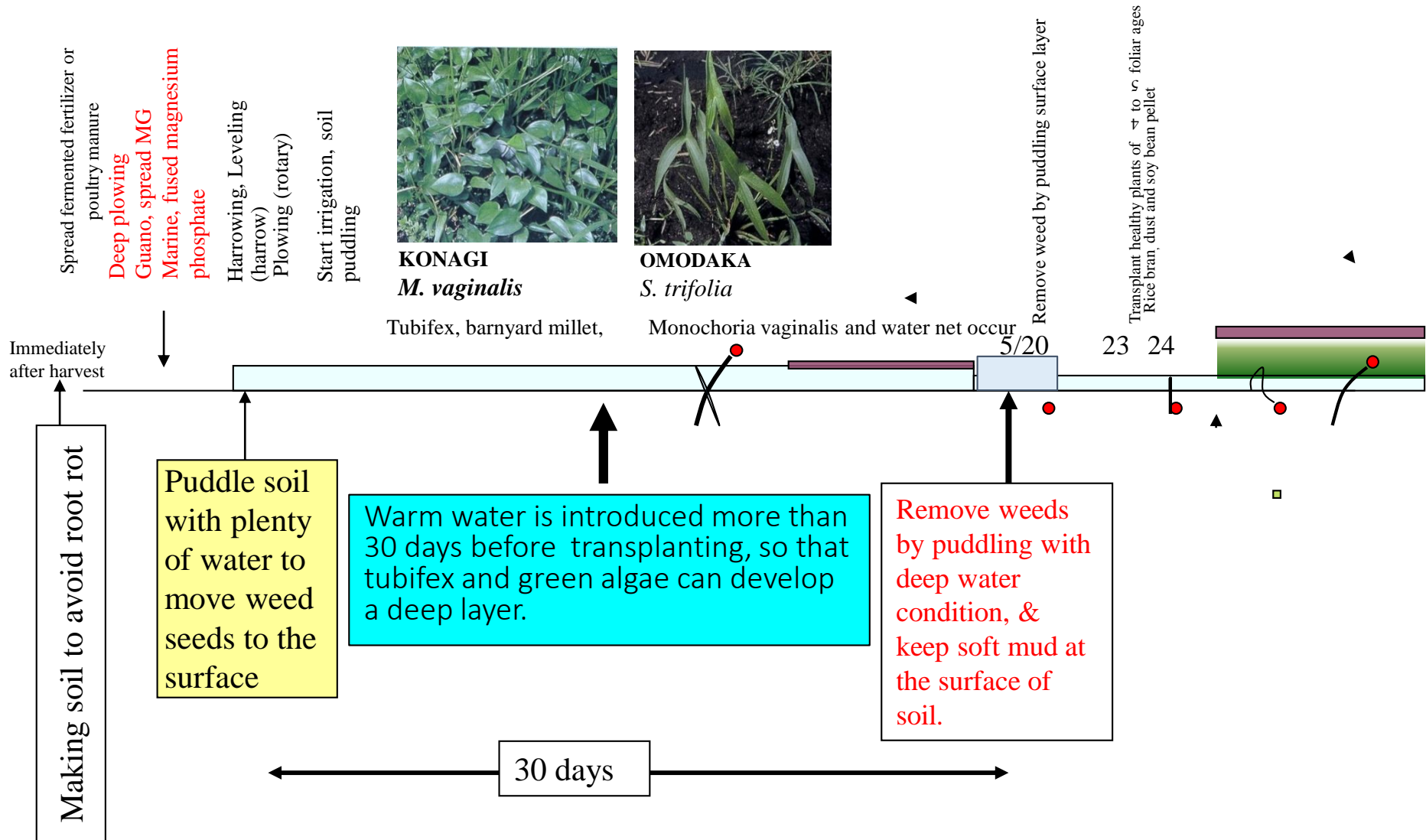
【Perennial weeds (Multiply by bulbs)】

- **Perennial weeds** such as *Eleocharus kuroguwai*, *Sagittaria trifolia* or **SHOCHUM** produce bulbs in **underground soil at 15~20cm depth in Sept. to Oct. They die out in dry condition. They germinate 15~25days after introducing water.**

【Weeds which can co-exist with rice plants】

- **Floating green algae** like *Spirogyra arcla* or *Spirodela polyrhiza* absorb **the excessive nitrogen in nitrous acid form, phosphorous, & potassium,** thus, purify the water. They also suppress the growth of KONAGI. They stabilize the temperature of water, and finally, become nutrition of rice plants after death.

Control of *monochoria vaginalis* by biodiversity based on early water filling in continuous rice cropping



Organic rice planted with single seedling in each pot vs. Conventional rice cultivation (3 to 4 rice plants in a pot using chemical fertilizer / pesticide)



Organic rice planted with single seedling in each pot

Conventional cultivation ; three to four rice plants in a pot using chemical fertilizer / pesticide)



There is no ineffective tillers, the stems are well aligned and thick



There are many ineffective tillers, the stems are irregular and thin

Comparison of yield and yield components between organic rice cultivation vs. conventional case (TOCHIGI Prefecture, Japan : Field of Civil Rice Research Inst. In 2010)

Studied rice field	Entire brown rice weight	Number of ears	Number of spikelets/ear	Total number of spikelets	Percentage of ripened grains	Weight of 1,000 pcs of whole rice grain	Falling	Content percentage of nitrogen to whole rice grain
	kg/10a	Number/m ²	spikelets/ear	$\times 100$ spikelets/m ²	%	g		%
Continuously organic	535	201	147	296	82.5	21.7	2.4	1.39
First year after conversion to organic	499	210	141	296	76.3	21.9	3.1	1.43
Conventional	535	317	92	293	83.1	21.7	4.1	1.39

Compared to conventional cultivation, organic cultivation has less number of ears. However, it has many spikelets per ear and this leads to the same yield between organic cultivation and conventional cultivation.

Continuously organic



First year after conversion to organic

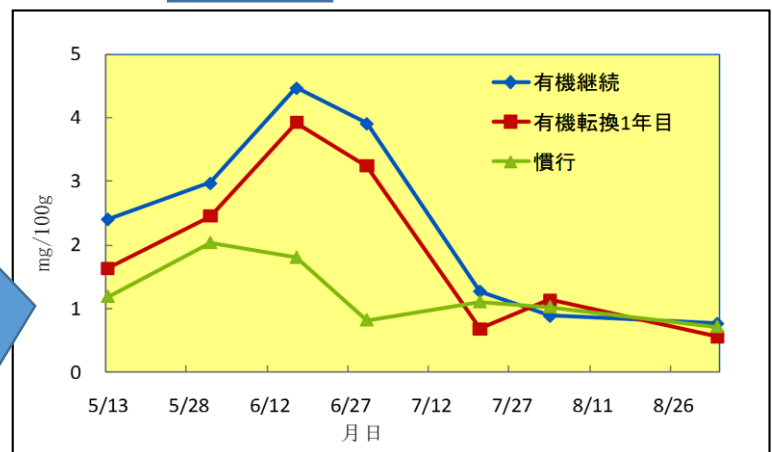


The amount of nitrogen component of fertilizer applied in conventional cultivation is 6 kg / 10 a and 2.2 kg / 10 a for organic cultivation, but the nitrogen component in crops is about 10 kg for both products.

In the organic cultivation, the Tochigi Prefecture Agricultural Experiment Station survey found out that a large amount of ammonia nitrogen was supplied by soil microorganisms from late May to early July.

Amount of ammonia nitrogen released from organic paddy field

Tochigi Pref Agricultural Experiment Station Crop Department Survey 2010



Cultivation test in the Kingdom of Bhutan and Japan (2017)

Table 1 Survey of Component of Yield (in 2017 variety; SASANISIKI)

Field	Number of Panicle	Number of grains per head	Total grains number	Ripening Ratio	Weight of 1000 grains	B-yield	G-yield
Paro	257	124	31,894	(76.6)	21	513	641
Thimphu	314	97	30,458	78.3	22	524	655
Japan	256	142	36,263	82.4	20	597	746

Table 2 Survey of Component of Yield (in 2017 variety; IR26, 64)

Field	variety	Number of Panicle	Number of grains per head	Total grains number	Ripening Ratio	Weight of 1000 grains	B-yield	G-yield
Bajo	IR28	255.7	177.4	45,358	79.4	16	576	720
	IR64	313.8	121.4	38,090	85.0	16	518	648

Result of cultivation test in Federal Republic of Myanmar who tested IR variety in 2018 (6 janu 2018、～ 8,may Pew Agricultural Experiment Station)

Table 1 Yield Component

試験区 Examination plot	植付密度 (本/㎡) Planting density (stock/㎡)	1株穂数 Ear/ stock	1穂粒数 Grain number /head	総もみ数 (総籾重/㎡) Grain number/㎡ (Grain weight/㎡)	登熟もみ数/㎡ (登熟籾重 g) number of Ripened grain/ ㎡ (Ripened grain weight	登熟歩合 (重量比) Percentage of ripened Grain (weight)	千粒重 Thousand grain weight	籾収量 (g/㎡) Grain Yield
有機成苗 (Organic)	14.0	24.8	134.5	44,654 (905.6g)	34,533 (842.6g)	77.3 (93.0)	24.4	842.6
化成成苗 (Chemical)	10.0	24.0	127.9	30,696 (541.3g)	18,143 (444.5g)	59.1 (82.1)	24.5	444.5



Average stem Number
Org 30.5 chem 19.2



Organic vs. Chemical
Fertilizer



Organic vs. Chemical
Fertilizer

試験区 Examination plot	投入窒素量(kg/10a) ⒶInput nitrogen	産出窒素量(kg/10a) ⒷOutput nitrogen	窒素効率Ⓑ/Ⓐ Nitrogen Fixation
有機成苗 (Organic)	$45 \times 0.05 = 2.25$	$842.6 \times 0.8 \times 0.02 = 13.48$	5.99
化学成苗 (Chemical)	$75 \times 0.15 = 11.25$	$444.5 \times 0.8 \times 0.02 = 7.11$	0.63

Construction of organic agriculture with soybean cultivation as the core

By crop rotation with rice, wheat and soybean, organic farming with material circulation is completed, preventing global warming, achieving a healthy society and keep the fertility of soil.



Nitrogen fertilizer is produced from natural gas — Factors of global warming

①Soybean nitrogen fixing is 24 kg / 10 a (Clover, Hairy Vetch, Astragalus 4kg) Nitrogen is fixed in the cultivation field and rhizobia remains, so wheat, raper , rice can be cultivated without nitrogen.

②Soybean oil with harvested soybeans, produce organic fertilizer with defatted soybean (same protein composition as nitrogen-fixing bacteria) and put it in Then, nitrogen-fixing bacteria are activated, and high yield is realized without root rot



Cropping system of recycling type organic agriculture

年次	作物	1	2	3	4	5	6	7	8	9	10	11	12
1年目	Wheat rice - barley	[Yellow bar]					▽	●	[Blue bar]			▽	[Orange bar]
2年目	Barley soybean - wheat	[Orange bar]					▽	●	[Green bar]			▽	[Yellow bar]
3年目	Wheat - rice - Canola	[Yellow bar]					▽	●	[Blue bar]			▽	[Orange bar]

Circulating organic agriculture that discriminates from modern agriculture that has been exploited through chemical fertilizers and Pesticide and forced to destroy the environment

Biodiversity Organic Rice Cultivation And recycling organic farming that rotates rice·wheat·soybean is a sustainable low cost·high yield agriculture that is replaces modern agriculture that use a lot of pesticides and chemical fertilizer

- The seeds used will be about 1 / 10th of the customary cultivation. (The amount used per 10 a is about 350 g)
- 2 to 3 times of puddling and deep water management to suppress the weeds. Weeding is unnecessary
- Sustainable organic agriculture by keeping biodiversity and conducting biodiversity control (IBM) to utilize it for pest control. The economic burden of purchasing pesticide is lost
- The yield is equal to or higher than that of customary cultivation, and the cost becomes less than half. In Japan, the selling price will be doubled, enabling expanded reproduction.

▪ By incorporating soybeans with the highest nitrogen fixing capacity into the rotation system, fertilizer is self-sufficiency, it will drastically reduce chemical fertilizer plant, absorb carbon dioxide and contribute to prevention of global warming.

▪ It can process agricultural products produced by organic cultivation, can work with regional processors and consumer organizations and contribute to the development of regional economies.

Thank you for listening!



Biodiversity control in organic rice cultivation

By applying rice bran, Chironomids & tubifex increase, which provide feeds for frogs & spiders

Insect feed
(ただの虫ではない)



Chironomids



ミジッコ



Chironomids larvae

Harmful insects



Plant hopper



Stink bugs



ツマグロヨコバイ



Bee as a parasite of plant hopper

Predators



Spiders



アマガエル



アカガエル



Spiders make net & move around

Puddle in April with water, & postpone to drain water from middle of June to July, **then, frogs and dragonfly increase!** Spiders & bees increase also!

Earth-making by organic fertilizer (Bokashi fertilizer) fermented with local organic resources and indigenous microorganisms

(Apply to paddy field immediately after harvest; application of upland field away from root)
 Basal dressing fertilizer in paddy fields, use organic fertilizer made from defatted soybeans.

