INTERGOVERNMENTAL GROUP ON TEA

INTERSESSIONAL MEETING

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Report of the Working Group on Organic Tea[1]

[1]Submitted by China and Japan.

Background

The FAO-IGG Intersessional Meeting in Washington DC, USA during 17-18 September, 2012 have worked out the following outlines for the Working Group of Organic Tea:

The Secretariat will update the intersessional meeting on generating market information and developing market strategies and on the certification process for tea production.

Report on progress made on the technical requirements – particularly the recommended package of practices – being adopted by member countries.

Provide an update on considering organic tea as low energy input for financial gain through carbon trading and on joining the organic movement for sustainability.

The Working Group of Organic Tea has Co-chairs: China and India, and has members: Bangladesh, Iran (Islamic Republic of), Japan and Sri Lanka. Withing the group, we have job divisions, China mainly focuses on green tea and India on black tea. Here is the progress made for the organic green tea production.

Progress of the technical requirements for organic tea production

There are many technical requirements for organic tea production. These requirements include the selection of organic tea gardens and the improvement of its environment, soil quality improvement, pest, disease and weed integrated management, leaf plucking and processing technologies and package material improvement, and so on. However, the most important technical requirements are the soil quality improvement and pest and disease management sine no chemical fertilizers and pesticides allowed to use in the organic tea gardens.

1. Integrated soil management.

To improve soil quality, the following technical measures are recommended:

- **Soil conservation.** The soil conservation measures should be adopted to prevent further losses of agricultural land and decline of tea yield. These measures include cut-ff drains between tea garden and its upward side mountain, and between tea rows in a certain distance, bench terrace if the tea land slope is above 15° (if slope more than 25° , the land is not allowed for

cultivation in China), grass strips between tea rows, planting tea tress arond contour lines, mulching, good coverage of tea bushes, no tillage and/or reduced tillage in slope lands.

- **Soil quality improvement.** Since no chemical fertilizers are permitted in the organic tea gardens and tea as a leaf harvested crop, organc fertilizers, espercially high nitrogen organic fertlizers should be applied. A commercial biofertilizer with Trichoderma harzianum and other effective microbes and relatively high nitrogen content was developed and extensively used in organic tea fields in China. Slow release orgnaic fertilizers are applied in Japan. The organic fertilizer should be applied twice a year, normally in Feb and Aug. At least 10% yield increase could be acheived compared to once a year in Sep.

- **Combination of animal husbandary and organic tea production.** For getting more organic fertilizers, an animal farm under organic or GAP management should be established in a large organic tea farm or by its neighbours. The naimal waste is processed as an organic fertilizer. For small organic tea farms, “pig raising ─ biogas slurry ─ tea garden” ecological agricultural system is recommended. Biogas slurry not only supply the nutrients, but also water to tea trees. The improvement of tea yield and quality are better than normall organic fertilizer (Han et al, 2011).

- **Development of tea varieties for organic tea production.** The selection of tea varieties with high nutrient use efficiency, especially low nitrogen requirement, or with high pest and disease resistance, especially to some key pests such as tea green leafhopper, have been initiated in China. It has long term goal for the improvement of organic tea production.

2. Integrated pest and disease management

A. Practices adopted in China

The main achievement is the developement of biopesticides, including nuclear polyhedrosis virus (NPV), bacterials, infochemicals, and some physical and mechnical measures to control key pests, such as tea green leafhopper, tea geometrid (Ectropis oblique), caterpillar of Euproctis pseudoconspersa Strand and spiny white fly. Two NPVs namely EoNPV and EpNPV, which control

caterpillars of tea geometrid and Euproctis pseudoconspersa Strand, respectively, are commercially produced in both powder and aqueous solution. Bacillus thuringiensis (Bt) is used solely and together with NPVs. A high efficacy of entomogenous fungi was also developed to control tea green leafhopper, but is still under experiment.

Green or yellow colour plates with info-chemical preparations to cotrol tea green leafhopper and spiny white fly are extensively used not only in organic tea gardens, but also in conventional ones. An infochemical to control caterpillar of geometrid are still testing in the fields. The high-pressure insecticidal lamp with solar energy or electricity was extensively applied in organic tea fields. Some plants and minerals originated pesticides, such as matrine, fish cany ketone, pyrethrum and petroleum oils are commercially produced.

Together with above biopesticides, some other agricultural, physical and mechanical measures and ecological balance recovery in tea garden and its surroundings, also integrated as an integrated pest and disease management. However, to reduce pest and disease problems, more research and development should be done.

B. Practices adopted in Japan

Tea breeding for cultural control of pests

The major Japanese tea cultivar ‘Yabukita’ was screened by Hikosaburo Sugiyama at the beginning of the twentieth century. It was found to be superior to other tea cultivars in terms of yield, local adaptability, and green tea quality in the 1970s. Consequently, the area where ‘Yabukita’ is cultivated has increased such that it occupies approximately three-fourths of the tea fields in Japan that are used for green tea production. However, the monoculture of ‘Yabukita’ has caused severe pest problems. ‘Yabukita’ is susceptible to various insects and diseases; therefore, a multiple-pest-resistant cultivar is required by tea farmers.

Developing pest-resistant cultivars in tea pest management is essential, particularly in organic tea cultivation. The major tea diseases prevalent in Japan are anthracnose (pathogen: Discula theae-sinensis) and gray blight (pathogen: Pestalotiopsis longiseta); the most detrimental tea insect pest is the white peach scale (Pseudaulacaspis pentagona). Pest resistance in tea plants has been developed by assay and selection methods, and pest-resistant cultivars have been selected (Table 1). The late-budding green tea cultivar ‘Minamisayaka’ is resistant to the above-mentioned pests (Fururo et al. 1997, 2001) whereas the

high-quality black tea cultivar 'Benifuki' is disease resistant (Takeda et al. 1994). The semi-early budding green tea cultivar 'Yumekaori' is resistant to gray blight and white peach scale, but not to anthracnose (Nagatomo et al. 2007); the semi-early budding novel green tea cultivar 'Saeakari' is disease resistant (Yoshida et al. 2011). 'Saeakari' is a high-yielding cultivar that produces high quality green tea and grows vigorously. These four cultivars are useful for organic tea cultivation. Organic tea farmers could select tea cultivars from these that are suitable for their local climate.

Table 1: Disease- and insect-resistant tea cultivars in Japan

Cultivar	Registered Year	Disease		Insect
		Anthracnose	gray blight	white peach scale
Minamisayaka	1991	R	R	R
Benifuki	1993	R	R	S
Yumekaori	2006	S	R	R
Saeakari	2010	R	R	S

R: resistant, M: moderately resistant, S: susceptible.

Physical pest control

Physical pest control methods are useful for organic tea cultivation. An insect-trapping machine with a blowing apparatus, which uses moist air to blow off or trap insects on tea plants, has been developed as a physical pest control method for tea cultivation (Miyama et al. 2009, Fig.1). This machine blows the tea green leafhopper (Empoasca onukii) off tea shoots. Twice-weekly treatment with this insect-trapping machine is recommended to maintain the yield and quality of tea obtained using pesticide-free cultivation.

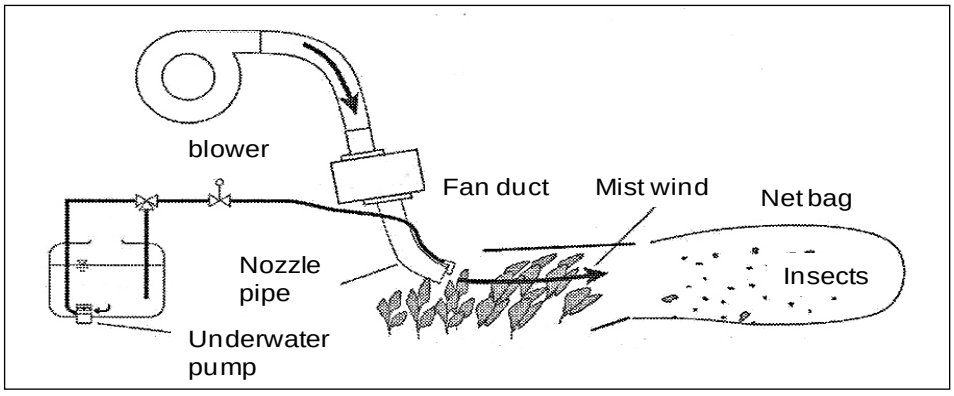

Figure 1: Diagram of insect-trapping machine (Miyama et al. 2009)

Intermittent spraying of water with a sprinkler can control white peach scale (Sato 2007). When tea branches are kept wet by intermittently sprinkling water (120–

150 t/ha per day) during the day, P. pentagona eggs become discolored and die under the mother's scale. The high humidity conditions created using the sprinkler for 16 days after the first hatching of P. pentagona eggs results in effective control of this pest in tea fields.

Permitted agrochemicals in the Organic JAS system

According to the Organic JAS system, the use of certain agrochemicals, mainly plant and mineral original may be permitted in cases of imminent or serious threat to the crop by tea pests. Copper fungicide is used to control fungal diseases and bacterial shoot blight (Pseudomonas syringae pv. theae). A petroleum oil-emulsifiable concentrate is effective for controlling Kanzawa spider mites (Tetranychus kanzawai) and pink tea rust mite (Acaphylla theavagrans) just before the first crop of tea germinates (Yoshioka et al. 2010). Synthetic sex pheromones of the smaller tea tortrix (Adoxophyes honmai), which are effective in disrupting communication in the moth stage, have been developed (Yoshioka and Sakaida 2008). Some biopesticide formulations, such as granulosis virus and Bacillus thuringiensis formulations have also been developed to control the smaller tea tortrix and oriental tea tortrix (Homona magnanima).

3. Improvement of biodiversity in organic tea gardens

The improvement of biodiversity or recovery of ecological balance in organic tea gardens is the key factor to pest and disease control and also soil fertility management in long run. The main measures include intercropping especially with leguminous crops, such as soy bean, peanut and cloves. A new leguminous green manure crop, namely No. 1 Green Manure Crop was recently developed by Tea Research Institute of the Hunan Academy of Agricultural Sciences. It can be cutting 3 times a year and has high biomass. It can be planted in young tea gardens, but also mature tea gardens.

Shading trees should be planted along with the road and field side. Shading trees inside of tea gardens are not encouraged in the subtropical zone since it will reduce yield and quality of tea. Raising chickens and sheep in organic tea gardens was also recommended, which can not only control pests and improve soil fertility to some degree, but increase farmers' profit through the chickens and sheep selling.

In March, 2013 data for 2,4-D and Imidacloprid were submitted by India to national Codex Point for evaluation by JMPR under 2014 JMPR Follow-up Evaluation Schedule.

Under 2015 JMPR New Compounds Schedule, the pesticide Fenazaquin and Under 2015 JMPR Follow-up Evaluation Schedule, Acetamiprid and Tebuconazole are included. These two compounds are in the priority list and work on data generation is in progress. In India till date 4 field trial data is available. Sri Lanka have 8 field trials for Tebuconazole.

China has submitted data on Indoxacarb in tea to Codex, based on eight field trials conducted in China. The MRL of indoxacarb was approved at 5 mg/kg in JMPR meeting in October, 2013 and will be discussed further as Codex MRL in tea in JMPR meeting in May, 2014.

Update on low carbon trading and organic movement of sustainability

Update on considering organic tea as low energy input for financial gain through carbon trading and on joining the organic movement for sustainability, main focuses on R&D to get qualitative or quantitative information on how much carbon sequestrated and greenhouse gases emission reduced, low carbon regulation/standard development, and attend various activities to power the organic movement.

1. Carbon credit comparison between organic and conventional tea gardens

Intensive agriculture is responsible for large amounts of greenhouse gases and contributes 10-15% of the total global greenhouse gas emissions. Organic agriculture can be part of the solution. TRI CAAS is focusing on two critical issues: one is carbon sequestration in organic tea soils and its quantification, the other is mitigation of greenhouse gases (mainly N2O and CO2) emission in organic tea fields compared to the conventional ones and its quantification.

A systematic comparison between organic and conventional tea production has been conducted. The results showed that soil pH, total organic carbon and nitrogen contents were higher in organic fields of all five comparative pairs. The organic carbon content in organic fields was 7.2 percent higher on average than its conventional ones. The carbon sequestrated in the organic soil is one percent more annually than its conventional counterpart (Table 2). In addition, the biomass carbon, ninhydrin-nitrogen, and ratios of biomass carbon to total organic carbon, biomass ninhydrin-nitrogen to total nitrogen were significantly higher in organic fields in most of the comparison (Han et al, 2013). The nitrous oxide (N2O) emission was lower in organic tea soils. Further researches are still going on to calculate the carbon credit under the organic management.

Table 2 Soil pH, organic C, total N contents in the fields under different management systems in five farms

Farm	Management	Years under organic farming	pH (H2O)	Organic C (g kg-1)	Total N (g kg-1)
Wuyi	Organic	11	3.86±0.11	19.1±0.3 a	1.89±0.04 a
	Conventional		3.53±0.07	17.5±0.2 b	1.70±0.02 b
Yiwu	Organic	9	4.40±0.30	14.2±0.8	1.23±0.09
	Conventional		3.72±0.12	13.3±1.5	1.00±0.06
Shaoxin	Organic	8	4.21±0.08 a	20.7±1.7	1.63±0.09
	Conversional	2	4.05±0.08 a	18.2±1.5	1.47±0.01
	Conventional		3.86±0.01 b	18.7±0.4	1.53±0.15
Lanxi	Organic	6	3.95±0.21	14.7±0.6	1.15±0.15
	Conventional		3.73±0.24	14.3±3.6	1.20±0.10
Jiangshan	Organic	3	4.07±0.05	9.6±0.3	0.70±0.00
	Conventional		3.81±0.08	9.3±0.3	0.70±0.00

Note: the different letter after figures in the same farm means significantly different (P<0.05).

2. Low carbon certification regulation

This work is still going on, though the primary one has been drafted by the Organic Tea Research and Development Center (OTRDC), a leading certification body in organic tea certification in China. The OTRDC could be a third-party to make low carbon certification or verification in the future. It is a result of the project “Tea safety and key standardized technologies development in tea cultivation and their extension” sponsored by the Ministry of Science and Technology of China. This regulation covers every aspects of organic tea production from farming to packaging, which could not only improve the environment for sustainable tea production through increase such as soil organic carbon concentration and energy use efficiency, but also get financial return from the possible carbon credit marketing. The main components of the regulation are as follows:

- Establish a Producer Low Carbon Plan (PLCP), which can conserve natural resources, avoid adverse effects to the environment (e.g. topsoil erosion and degradation, emissions of air pollutants and greenhouse gases), improve tea production and quality, increase agricultural input and energy use efficiency. This PLCP should be implemented and documented.
- Constructing good and balanced ecological environment, enhancing biodiversity in tea garden and its surroundings.

- Integrating tea production with animal husbandary on-farm or on neighboring farms to realize greater sustainability and benefit soil management, nutrient cycling, and pest control strategies.
- Adopting soil conservation methods that limit or prevent soil erosion.
- Implementing approaches to nutrient management and tillage that retain and utilize soil nutrients, select and use nutrients or soil amendments that minimize accumulation of toxic substances in soils, reduce the potential for movement of nutrients to surface and groundwater, and match nutrient input to tea plant needs.
- Using an appropriate combination of soil tests and plant analyses for planning nutrient management strategies and optimizing soil pH and availability of essential nutrients. Soil test should be done in every two years in principle.
- Maintaining or improving soil organic carbon content to sustain productivity and to support the biological activity and diversity that contribute to nutrient cycling. Effectively using green and animal manures, soil amendments at times and at rates that meet tea nutrient needs to increase nutrient use efficiency and minimize nutrient losses to the environment.
- Quantifying the increase of tea plant biomass and soil organic C, and the reduction of greenhouse gasses (mainly N2O) emission.
- Adopting the approach of integrated pest and disease management, that balances cultural, biological, and mechanical controls in a way that avoids environmental risks, pesticide residue in final tea products, and minimizes pesticide off-target movement.
- Improving tea bush coverage through appropriate pruning and plucking.
- Increasing use renewable energy (e.g biogas), renewable materials, and renewable agricultural inputs, and nonrenewable energy efficiency in the tea farms and processing factories.
- Increasing use recycled package materials. Reusing containers, paper products, and other materials whenever possible and recycling unneeded materials.

3. Joining the organic movement

Organic tea is just one of the organic agricultural products. The prospect of organic tea not only relies on these people involved, but also largely depends on

the organic sector as a whole. Therefore, joining the umbrella of organic movement could get twice the result with half the effort. TRI CAAS as a member of the IFOAM, the staff attend as much as activities held by IFOAM and its related organizations, to power the organic movement in China and around the world.

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