Study of the Causal Pathogens of Tea Dieback Disease

Hsiu-Sui Lin

One hundred-and-three twigs of die-back diseased tea plants were sampled during the spring to autumn period of 2003 in Taiwan. Three kinds of fungi were frequently isolated from those diseased twigs, including 24 isolates of Colletotrichum spp. (isolation ratio 23.3 %), 9 isolates of Phomopsis spp. (isolation ratio 8.7%) and 81 Macrophoma spp. The pathogenicity tests were executed by artificially inoculating the 18-month-old seedlings of one of the most sensitive cultivar of Camellia sinensis planted in pots in a plastic greenhouse. After 2 months of observation, the results of pathogenicity test revealed that the virulence of all isolates of both Colletotrichum spp. and Phomopsis spp. were quite low. Meanwhile, the virulence of most isolates of Macrophoma spp., although varied, was much higher than the other two fungi. When artificially inoculated to the tea seedlings, Macrophoma isolates could produce the typical symptoms of tea die-back and could be successfully re-isolated from diseased twigs. Therefore, the major pathogen of tea die-back disease in Taiwan should be Macrophoma spp and they were identified as Macrophoma theicola Petch, according to the previous reference of Petch and Chen. The results of physiological tests showed that the optimum temperature range for the mycelial growth of Macrophoma theicola Petch were in the range of 25-35℃and the optimum pH range are between pH5 and pH7. The mycelial growth rate of Macrophoma theicola Petch is fastest under NUV, then in continuous light and slowest in darkness.

Key words：Camellia sinensis, Tea die-back, Pathogenicity, Macrophoma

Study on the Pathogenicity of Dematophora necatrix Isolated from Camellia sinensis

Hsiu-Sui Lin Huann-Ju Hsieh

White root rot pathogen was isolated from root rot sample of Camellia sinensis (L.) O. Kuntze gathered in one dieback disease from a suffering tea garden in Nantou. The young colony of pathogen on PDA appeared white and velvety, while colony aged melanin was produced. Since some aged hypha had the characteristic pear-shape swellings near septa, the pathogen was identified as Dematophora necatrix Hartig. Pathogenicity tests were performed with a variety of conditions in a plastic greenhouse using Chin Shin Oolong tea cuttings as the material for artificial inoculations under room temperature and a humid environment in the spring and autumn of 2004, separately. Dematophora necatrix could be re-isolated from the diseased tea cuttings to fulfill the Koch's postulates. As time and costs are considered, the optimum condition for pathogenicity test is 20g of 1M old oat grain as inoculum with 1 year-old Chin Shin Oolong tea cuttings as the host, incubated in a plastic greenhouse under an ambient environment. Both the acute and chronic symptoms of white root rot were initialized around 1month after the artificial inoculations and the disease development was suitable for evaluation during 2 to 3 months.

Key words：Camellia sinensis, Tea root disease, Dematophora necatrix, Pathogenicity test

Flowering Habits of Tea Plant

Chui-Feng Chiu Dhe-Ming Chu

The field experiment results showed that there are over two thousand flower buds and a few fruits in both tea cultivars. When the leaf buds sprout in spring, so does the flower buds. But most of them aborted and then abscised, only a few keep growing and develop into flowers. As for the flowering sequence on the tea branch, it starts at the 3rd or 4th leaf position and then proceeds gradually upward and downward. The number of the flower buds and the number of the blossomed flowers above the plucking surface are larger than those under it. Furthermore, the tea tree has the largest number of the flower buds in summer, fewer in the spring or later summer (second summer tea season), and the least in the winter. The top flowering season is in the mid or late November in both cultivars. In TTES No.12 and Chin-Shin Oolong, it takes about 117 and 123 days respectively for the flower buds to bloom. Within a day, most of the flowers blossom around 7 or 8 AM and cease to bloom after 9 AM. The flowers of the tea tree are short-lived that most of them wilt or abscise within 48 hours after flowering.

Key words：Tea, Flowering habits, Flower bud

Effects of Different Cover Crops on the Soil Environment and Growth of Tea Trees,I: Influence on Soil Environment in Tea Farms

Shin-Yan Chen Hun-Yuan Cheng Horng-Jey Fan Ching-Hsiang Hsieh

The study was conducted to investigate the influence of different cover crops on the soil environment in tea farms and growth of tea trees. Four entries of cover crops were chosen, included perennial peanut Golden Glory (treatment A), perennial peanut Amarillo (treatment B), Trailing Indigo (treatment C), Asiatic Pennywort (treatment D), and cultivated in a tea farm along with the control treatment (uncovered field, CK).

The results showed that the root of perennial peanut (Golden Glory) formed a dense inter-mingled network in soil, which can prevent soil erosion efficiently. Its rapid growth character was able to endure high mowing frequency, and with a rapid recuperative rate to inhibit weed growth. The percentage of weed biomass per year was lower than control treatment at 78.1 to 85.4% and treatment B was next efficient to show such effect. Variation of soil temperature in treatment A, showed that the soil temperature dropped to 7.74 and 6.6% at 10 and 20 cm underground in summer. This was followed by treatment B. The day and night temperature difference (3.08%) in treatment A, was minimum at 10 cm underground, and the difference of treatment C and control were 5.15 and 9.79%, respectively. In tea farm of cultivar TTES No. 12, both perennial peanut Golden Glory and Trailing Indigo were cultivated for 1 year, the result showed significant increase in pH and organic matter contents of topsoil and subsoil. In the preservation of soil water and improvement of soil hardness in tea farms, both treatment A and C performed excellently.

Key words：Tea tree, Cover crop, Perennial peanut, Soil environment

Effects of Different Cover Crops on the Soil Environment and Growth of Tea Trees, II: Tea Growth and Tea Quality

Shin-Yan Chen;Horng-Jey Fan;Hun-Yuan Cheng;Ching-Hsiang Hsieh

The study was conducted to investigate the influence of different cover crops on soil environment in tea farms and growth of tea trees. Four entries of cover crops were chosen, including perennial peanut Golden Glory (treatment A), perennial peanut Amarillo (treatment B), Trailing Indigo (treatment C), Asiatic Pennywort (treatment D), and cultivated in tea farm along with the control treatment (uncovered field, CK).

The fresh tea leaves yield in treatment A of different seasons increased significantly from 25.06 to 81.14%, and 38.5 to 90.57% in treatment C, but decreased in treatment D in the 2nd year of the experiment. The quality of tea buds in treatment A and C were better than control. Chemical contents（including minerals）of tea bud and green tea, and evaluation of manufactured tea quality showed no obvious differences among all treatments. There was no distinct variation in tea quality among all treatments.

In summary, perennial peanut Golden Glory was the best cover crop in a tea farm for this experiment, and a recommendation can be made to investigate the model of long-term cover crops on tea cultivation management. This information provides consultations to farmers for application and promotion of this system in the future.

Key words：Tea tree, Cover crop, Perennial peanut

Establishment of Numerical Measurement Method for Plucking Shoot Color in the Tea Plant, I: Establishment of Numerical Databank for Bud and Leaf by Color Difference Measurement

Horng-Jey Fan Hun-Yuan Chen Ming-Shaiun Guu

In this study numerical databank for tea bud and leaf color was set up for different tea cultivars. Tea cultivars were sorted and divided into groups to screen different blades color. Color difference measurement was conducted on the three-leaf bud of tea cultivars in Cultivar Field No. 1 ~ 121 (actually 117). The best position of measurement was the down-left of the third leaf. There were four parts of the bud color. The first was deep-green, second part was green, third part was light-green, and the fourth part was yellow-green. There is a slight difference according to the region's cultivars and season. The color of tea bud became greener as it grew. The content of chlorophyll also increased. The SPAD value increased with the development of tea bud. SPAD value and Hue angle (H*(ab)) presented a positive correlation. Correlation coefficient was 0.94. The values of SPAD and color difference meter were high. The a* value was more negative, and the color was dark green. So the hue angle was nearing 130 degrees.

Key words：Tea tree, Color of bud and leaf, Hue, Color difference meter

Establishment of Numerical Measurement Method for Plucking Shoot Color in the Tea Plant, II: The Varied Hues of Tea Buds during the Tea Shoots Development

Horng-Jey Fan Hun-Yuan Chen Ming-Shaiun Guu

From winter pruning after 67 days, TQS of made tea decreased with the increase of development period and extension of plucking period. After 88 days, good quality tea cannot be made. The yield mode of SPAD was y=-36.62 x2+237.68 x –165.67 (R2=0.988**), y = yield, x = SPAD. The highest plucking yield was when the SPAD of bud hues was 49. The yield mode of hue was y=-5.43 x2+1337.1 x –82325 (R2=0.993**), y = yield, x = H* value. The highest plucking yield was when the Hue of bud hues was 124. The development mode of tea shoots was a quadratic equation. It displayed the phenomenon of life. The chemical compositions of made tea were affected by different plucking days. The varied hues and the different plucking period of tea buds were expressed in the chemical compositions of tea during the development period of tea shoots. The values were differentiated by color difference measurement. The qualities were differentiated by the kind of made tea.

Key words：Tea bud, Pluck, Hue, Color difference meter

Developments of Tea and Hsien-Ts'ao Combination Products

Hsiu-sui Lin Mu-Lien Lin

The best treatment, among the four different temperatures (80℃, 100℃, 110℃ and 120℃) with five separate time courses (2h, 4h, 6h, 8h, and 10h), for hsien-ts' ao products was 110℃ for 4h. A temperature of 110℃with 2h to 6h roast periods would not cause negative effects to hsien-ts'ao flavor. By ascending the hsien-ts'ao ratios, the green tea and roasted hsien-ts'ao combination products became more acidified, more reddish, yellowish and with deeper liquor colors. The best-flavored combination product was at the ratio of hsien-ts'ao to green tea of 3 to 1. The flavor at the ratio of the hsien-ts'ao to green tea of 2 to 1 also tasted well. The flavors of Oolong tea and hsien-ts'ao combination products were dependent on the sources and types of Oolong tea. However, their flavors were inferior to the others. With ascending roasted hsien-ts'ao ratio, the soups of black tea and hsien-ts'ao combination products became less acidified, less reddish, yellowish and lighter in color. The best-flavored combination product was the 3 to 1 ratio of roasted hsien-ts'ao to black tea. The flavor of the ratio of the roasted hsien-ts'ao to black tea of 2 to 1 also tasted fine. In summary, it was indicated the green tea and hsien-ts'ao combination might be a good idea. The black tea and roasted hsien-ts'ao combination products tasted good and showed the best stability in liquor colors and flavors. The flavors of Oolong tea and hsien-ts'ao combination products were inferior to the others.

Key words：Tea, Hsien-ts' ao, Roast, Color measurements, Sensory evaluation

Comparing the Volatile Compounds of Formosa Oolong Tea Sucked by Smaller Green Leafhoppers and Black Tea Thrips

Chih-Yi Hu Chih-Jen Lee

Using Camellia sinensis cv. Chin-Shin-Oolong as plant material to compare the volatile compounds of Formosa Oolong Tea made of tea leaves with feeding damage by smaller green leafhoppers and black tea thrips, by the SPME extraction and GC/MS analysis, we found that the treatment of smaller green leafhoppers contained more linalool oxide (furanoid type), linalool, and benzaldehyde, and to a lesser extent linalool oxide (pyranoid type), methyl salicylate, and 2-phenylethanol. Those are the different volatile compounds found between smaller green leafhoppers and black tea thrips treatments. We also found the treatment of black tea thrips contained 2,6-dimethyl-3,7-Octadien-2,6-diol which was almost the same amount as in the treatment of smaller green leafhoppers. Further experiments should be applied for confirmation.
Key words：Volatile compounds, GC/MS, SPME, Formosa Oolong tea, Smaller green leafhopper (Jacobiasca formosana), Black tea thrip (Dendrothrips minowai)

Study on the Relation Among Pigments and Manufacturing Process of Bai-hau Oolong Tea

Chun-Liang Chen Kuo-Renn Chen Zhi-Wei Yang;Ming-Huang Hsu Wen-Dar Huang Chi-Ming Yang

The object of this research is to understand the withering and shaking effect on tea fermentation, appearance of tea, and the change of the pigments and liquor color, to help us to judge the flavor quality and grade the tea.
Experimental results showed that the teas that are not infected by green leaf hoppers that contain more chlorophyll than teas that are infected. The chlorophyll content did not change significantly during the manufacture process. The carotenoid content, anthocyanin content, and flavonoid content increase during the manufacturing process while the polyphenol content decreases during the manufacturing process.
Key words：Tea, Chin-Shin Dapang, Sensory Tasting, Bai-hau Oolong tea, Pigments

Development and Improvement on the Miniature Rolling Machine of Black Tea

Jin-Chih Lin Chui-Feng Chiu Cheng-Chung Huang Ching-Hua Chien Ru-Hong Lin

The objectives of this study were to develop a small rolling machine for black tea, and to improve it by the results of a performance test. Development of this machine was expected to help the tea farmers to produce high quality striped Kong-Fu black tea, reduce the manufacturing costs, and increase their earnings. Results of this study showed that:
1. Two medium and small rolling machines of black tea had been designed, with a rolling volume of 5-10 kg and 30-50kg respectively. The new design patent (No. 266708) was permitted.
2. Some improvements were done in this research such as enlarging the rolling can, elongating the

connecting cantilever, changing the material of rolling plan to thinner copper strips or stainless steel, lowering the height of rolling can and setting security control switches. Through these improvements the machine structure can be strengthened effectively, and the tea leaves are turned, rolled and pressed more easily. Produced black tea had a neat strip shape, golden red and freshly bright color infusion, fresh floral aroma; and the flavor was mellow and fresh.
3. Compared to the new design rolling machine and the traditional rolling methods, the chemical analysis results of caffeine, total free amino acids and polyphenols of the new design of rolling machine are significantly higher than the traditional rolling methods, however, the difference in soluble contents are not significant.
Key words：Black tea, Tea rolling machine

Investigate the Knowledge of Pesticide Application for Tea Farmers in Taiwan

Zheng-Wei Lin Chia-Chang Wu Chin-Jin Hou

This research focused on the knowledge of pesticide applications for tea farmers in Taiwan. Using the statistical package of SPSS analyzed questionnaires, the results indicated that the tea farmer's age is mostly situated between 31~60, and most have an education level somewhere between elementary school to senior high school. The sequencing of farmers selecting the correct answer in questionnaires in accession number of pesticides, preparation of pesticides, and classification of pesticides, the ratio were 71%, 57.8%, and 32%, respectively. The level of understanding of pesticides by tea farmers was related to their age and educational degree. The tea farmer's age and the education level were negatively correlated; either in the experiences of field management and tea-making technology there was no obvious correlation. They were positively correlated with tea pesticide residue analyzed reports and tea selling process. There 81% of farmers that sell teas without hesitation, and 8% think that there are no influences. The most popular organization the farmers take part in was an agriculture production and marketing group. In order to reach the guidance purposes effectively, the extension education of pesticide application just could proceed the guidance through this organization.
Key words：Pesticide residue analysis, Agriculture production and marketing group, Tea

Studies on Consumer's Habit and Recognition for Tea Beverages

Shi-Ying Chen Chia-Chang Wu Chin-Jin Hou

The purpose of this paper is to investigate the habits of consumers and the security recognition for tea beverages of 19 cities in Taiwan. A total of 1,583 consumers completed questionnaires. Using the statistical package of SPSS analyzed questionnaires, the results indicated that the tea farmer's age is mostly between 31~60, the proportion of education level is mostly between elementary school to senior high school. Results indicated that there was 53% of consumers who often bought the tea beverages and 41% of consumers chose green tea beverages. There was 21.9% of college student's that chose tea beverages while the number was 18.7% for high school students. The

consumers that drank the most tea beverages everyday were young people primarily at one pot per day. The date of manufacture, shelf life and residues of pesticides are the main factors influencing consumers when buying tea beverages. Seventy percent of the interviewees think about the possibility of pesticide residues in tea beverages and ninety percent of interviewees hope to find indication of pesticides listed on tea beverage packaging. This research can offer a reference to the agricultural policy unit and beverage manufacturers about production and management of manufacture, and to insure the health and safety of consumer.

Key words：Tea beverage, Pesticide residue

Impact of Chemical Composition of TTES No. 18 Due to Variations of Processing Treatments

Cheng-Chung Huang Chun-Han Ko

Manufacturing procedures and process control profoundly influence the chemical composition of black tea. In this study, orthodox black teas were produced from TTES No. 18, selected by Yuchih branch, Tea Research and Extension Station, COA. Tea leaf chemical composition analysis was conducted for temporal control of rolling (R, R=60, 90 and 120 min) and fermentation (F, F=60, 90 and 120 min) process. There were five kinds of black tea, which produced with different treatments (F60-R90, F60-R120, F90-R60, F90-R90, F120-R60)

From the chemical composition analysis of tea leaf, total free amino acids and caffeine were not significantly changed with respect to various treatments both spring and summer teas. Total soluble solids are showed the same situation in spring tea. However, total catechins of summer tea decreased with increasing duration of rolling process. And the same situation is not showed in spring tea. For summer tea, total theaflavin increased with increasing duration of rolling process. R120-F60 treatment of summer tea has highest total theaflavin of 11.98 μmol/g. In addition, percentage of total colour increased with increasing duration of rolling process too.

Key words：Black tea, TTES No.18, Chemical composition