

COUNTRY REPORT: INDONESIA

CURRENT ACTIVITIES AND PROGRESS OF BLACK PEPPER R&D

Black pepper (*Piper nigrum* L.) is the most important spices and a very important trade commodity in the world. The crop has been cultivated before world war II as a small holder estate crops and are labor intensive commodity. The black pepper plantation in Indonesia are estimated around 120,000 hectare, it decreased gradually from 2003 when it reached 204,107 hectare. The plantation which about 95 % are smallholdings involving around 500,000 farmers. Black and white pepper are major products of *Piper nigrum* L. from Indonesia, other products in a lesser amount are essential oil, green pepper and oleoresin. Indonesian pepper production gradually decreased due to a number of constraints in cultivation which have not been solved, such as foot rot disease, viral and pest and climatic changes. To solve the problems a number of activities have been undertaken. Progress on such activities are described below.

Developing method for preparation of healthy planting material

Various diseases have been reported as serious constraint in black pepper cultivation in Indonesia, i.e. diseases caused by viruses, nematodes, and foot rot disease caused by *Phytophthora*. Foot rot disease is considered the most important disease in Indonesia that causes the plant to die quickly, fast spreading among the plants or plantations, and finally resulted in a significant loss of yield. Up to the present, there is no resistant varieties available in Indonesia, thus finding method which enable to inhibit the disease occurrence on the field is important. The causal agent of foot rot disease, *Phytophthora* is soil borne fungus that easily transmitted to newly planting field through contaminated black pepper planting material, soil and agricultural tools. Therefore, creating healthy and disease free planting materials was considered as important step in developing cultivation system of black pepper that minimize of fungicide application and economically affordable.

In 2009, a series of activities initiated by a FAO project had been conducted in attempt to develop healthy and diseases free planting materials of black pepper. The activities included brief introducing on how to cultivate black pepper properly, how to recognize pests and diseases in the field and its nature, as well as paper processing procedure that was carried in classroom. The out door activities included practicing on how to carry out black pepper seedlings preparation procedure appropriately. The practicing activities consist of preparation of i.e.: providing disease free planting medium through soil solarization of planting medium (soil : cow dung manure 2:1 ratio). The prepared medium was infested with beneficiary microorganisms (*Trichoderma* and *Pseudomonas fluorescens*). Selecting and preparation of single node cutting of black pepper as source of planting material, then it was followed by planting the cuttings on to the invested planting medium in

polybags. Mycorrhizal fungus (AMF) that prepared previously was infested to the cuttings a month later. A time, the cutting is starting for rooting.

From the small experiment revealed that the pepper cuttings that were grown in solarized medium then invested by beneficiary microorganisms grew better than the one grown on not solarized soil (as control). Plant height in averages were higher than control, the seedling mortality was lower than control. However, the obtained data still limited data of green house level.

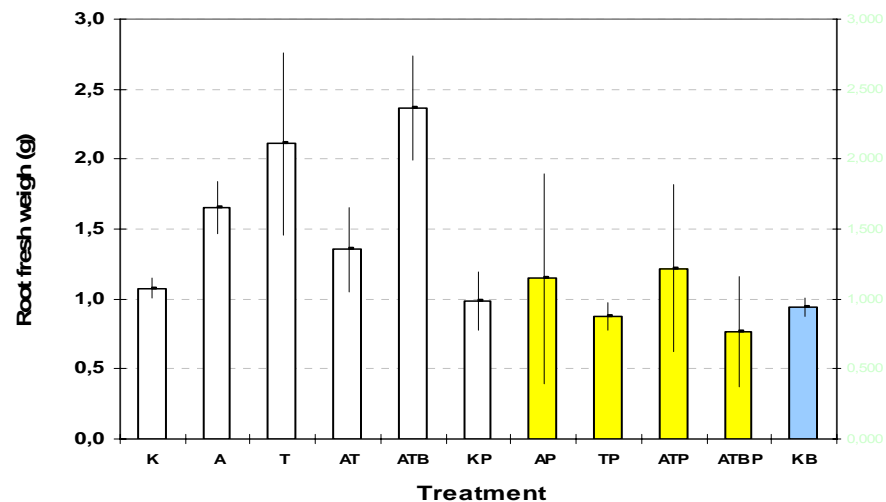


Figure 1. Root fresh weight of cutting after artificial inoculation by *Phytophthora* (■). Grown on not solarized medium (■) in the green house experiment.



Figure 2. Black pepper seedlings prepared using beneficiary microbes in Lampung.

Technically, the main constrain faced during the seedling preparation was the limitation of obtaining appropriate seedling for cutting materials. Viral diseases are widely distributed in black pepper planting areas in Indonesia. Selecting the healthy planting material as source of material for preparing healthy pepper cuttings is time consuming.

Since the insecticide application was avoided especially the one that having systemic mechanism. When there was insect pest on the prepared cuttings, mechanical control suppose to be carried out and the method of controlling probably is not suitable for large scale black pepper nursery.

The Assessment Institute of Agriculture Technology in Lampung distributed the prepared cuttings to local farmers. However, the monitoring of the plant status was not carried yet. It is necessary to carry out training for the official staffs on procedure of microorganism mass propagation.

Pepper cultivation

Pepper plantation are commonly cultivated in Lampung, Bangka and Kalimantan in several soil type such as Inceptisol and Ultisol. Soil fertility of these soil types are low so they need application of fertilizers. Dosage and composition of fertilizers for these soil types have been recommended to improve soil and plant productivity. Several farmers have practice organic farming using recommended technology such as biofertilizer, biopesticides and the use of living fence (living post), where fallen leaves can be used as soil nutrition.

Pepper improvement program for resistance to foot rot disease

Foot rot diseases caused by *Phytophthora capsici* is one of the major pepper cultivation constraints in Indonesia. Chemical pesticides, or biocontrol measures have been undertaken with limited success. Crop improvement of black pepper through conventional breeding has been started several years ago. A number of promising lines from intra and interspecific hybridization have been obtained and showed moderately tolerant in the laboratory, glass house and field experiment. These hybrid lines currently are under adaptation test in several pepper production centres.



Figure 3. Hybrid plants (left) and fruiting hybrid plant under adaptation test

Biocontrol method in controlling *Phytophthora capsici*

Biocontrol measures for controlling *Phytophthora capsici* is still far away, however, initial research has been undertaken. Exploration of chitinase producing bacteria in several pepper production centres in Bangka dan Lampung has found five isolates which showed good indication in inhibiting the growth of *Phytophthora capsici* 75-90% in the laboratory. Formulation of consortium bacteria and field testing of the formula is planned in the next coming year.

Developing management strategy for important pepper pests in Indonesia

Infestation by insect pest is of the main factors responsible for the low productivity of pepper in Indonesia as well as in major pepper growing country. It was listed 44 kind of arthropods associated with pepper plant ecosystem in Indonesia, which categorized as fitofag (47.73%), omnivorus (6.82%), natural enemies (34.09%) and pollination (11.36 %). Among arthropods which categorized as fitofag, there were three major pests of black pepper cultivation, i.e.: stem borer (*Lophobaris piperis* Marsh.), pepper bug (*Dasynus piperis* China) and blossom bug (*Diconocoris hewetti* Dist.). The potential loss of yield due to pests and diseases in Indonesia has been estimated around 20-50 % of total pepper yield, while in 1999, was estimated the loss of about 38,6 billion rupiah every year. Integrated pest management (IPM) concept approach for controlling plant pests and diseases. The control strategies should be accommodated to give much more attention to the productivity, efficiency, clean, health environment, and supported by government policy as well. Developing resistant varieties to pests and diseases, the use of organic natural matter for pests and diseases control, such as the use of botanical pesticides (derris, neem), the use of microbial pesticide (fungi, bacteria, nematode antagonist) and bio-fertilizer (micoriza), and conservation of crops plantation thru mix-cropping, planting of cover crops, etc, should be prioritized continuously to be the main program.

The farmer, especially in Bangka island is still use of synthetic insecticide in controlling of pepper pest with 1-2 ml/l concentrations and the level of application between 0 – 6 time per year. They use cypermethrin, organophosphate, fenthion and carbamate insecticides. The insecticide residue on product is very low (0.0037-0.0038 ppm of fenthion), while residual limit is 0.1 ppm. Research and development, supporting the IPM of black pepper have been introduced since 1999 in the area producing provinces.

Current status in pepper processing and product development in Indonesia

Black and white pepper are still the main products in the international trade from Indonesia. Pepper processing is done at farm level using traditional method. However, some effort have been done to improve the quality and processing efficiency by improving traditional method, constructing small-scale equipments for pepper processing which could be applied at farm level, and product sterilization. Common processing techniques at farm level are as follows:

Black Pepper

Black pepper is prepared from fully developed berries (6-7 months after flowering), having a dark green color and very solid content. Some farmers stack the berries in a gunny or plastic bag for a few days (2-4 days) before drying process in order to get uniformly dark color. However, some farmers dry the berries right after picking. The separation of the berries from their spikes is done by hand or foot. Soon after that, the berries are spreaded out on plastic or bamboo mats and sun dried for 5 to 7 days depend on the climate conditions.

White Pepper

White pepper is prepared from fully mature berries getting yellowish to reddish in color (8 to 9 days after flowering). The berries are packed in a plastic or gunny bags, soaked in slow running water for 8-12 days, the first 5 days the sacks are turned around. The skin (pericarp) of the berries is separated using hand or foot, followed by washing and sun drying. Sun drying is carried out by spreading out the berries on plastic or bamboo mats for 3 to 5 days depend on the climate condition.

Quality constrain

Harvesting at the correct maturity stage and ripeness is one of the main quality determining factors for pepper. The farmers are well aware of the requirements for the particular type of pepper which they are producing, but sometimes social factors conflict with good agriculture practice. For that reason, early harvesting sometimes happened to prevent theft especially when the price of pepper is high.

Soaking process in white pepper processing is also one of the important factors to get good quality of pepper. It need plenty of clean running water to get good quality of pepper. Some farmers use clean running water. However, in the areas where such condition is not available, static ponds are often used. At some places in Kalimantan, a few farmers use water sources from higher land and bring it down using pipe to reach the ponds and make it flow continuously. Beside the big pond there is a small one to control the amount of water coming in and out of the pond.

Such method produce creamy white pepper with good flavor. Drying pepper is still carried out by traditional method using plastic of bamboo mats. However, some farmers use cemented floor which build at their front yard, some of them also make fences around the mats to prevent contamination from domestic animal and birds.

Quality improvement

Government of Indonesia collaborated with pepper private industry have been trying to improve the pepper quality and processing efficiency at farm level by introducing semi mechanical processing method. Such method is combination between traditional and mechanical process. Some pilot projects have been built near plantation areas at pepper producing regions. The advantages of this method are ; produce higher quality of black and white pepper, more hygienic products, less processing time, and efficiently process.

IPC Good Agriculture Practice (IPC GAP) has been introduced to the farmers as well as to extension official, along with introducing the semi mechanical processing method.

There are demands from importing countries for a superior grade of white pepper, in which there are no grey or black pepper at all mixed in it. The exporters have responded by producing "hand picked" grade of white pepper which commands a premium price over other grades. The pepper is processed with the common method, and the individual pepper berries are sorted by hand. This is achieved by hundreds of women working six days a week.

Product development

Black and white pepper are the main products exported from Indonesia. However, there are other products exported in smaller amounts such as pepper oil, pepper oleoresin and ground pepper.

In Indonesia, pepper have been widely used as active ingredient in a few kind of traditional medicine called "jamu" since the ancient time. However, there are also some efforts to diversify pepper product, some of them have been introduced to the farmers, such as dried green pepper, pepper in brine and pepper balm.

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