



Impact of shear harvesting on the residues of hexaconazole and copper in black tea

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Black tea, manufactured from the tender shoots of *Camellia sinensis* (L) O.Kuntze is consumed all over the world. India is the major producer, consumer and exporter of black tea in the world. Generally, the tea leaves are infested by a wide range of pests and diseases. The climatic factors prevailing in the tea growing areas of south India favour blister blight epidemic during monsoon which extends over a period of about six months in an year. The disease caused by the fungus, *Exobasidium vexans* Masee is controlled by the application of a combination of triazole fungicide and copper oxychloride.

The combination of copper oxychloride and hexaconazole - (R,S)-2-(2,4-dichlorophenyl)-1-(1H-1,2,4-triazole-1-yl)-hexane-2-ol) is effective in tea blister blight control (Chandramouli and Premkumar, 1995). Harvesting of tea in India is done by hands, but in south India, due to acute shortage of man power, the tea gardens are now resorting to the use of hand-operated shears. In this context, the UPASI Tea Research Institute had made recommendations on harvesting using shears (Swaminathan *et al.*, 1990). Shear harvesting is recommended only during the high cropping periods. The harvesting interval between two successive shear harvests can be maintained at leaf expansion time (LET) in days \times 1.75 (Muraleedharan and Hudson, 2007). However, when the labour shortage is very severe, estates are extending shearing even to the low cropping period, almost covering the entire year. Plucking interval in the shear harvested fields range from 17/18 to 21/22 days in different months. In view of this, there is a need to study the impact of shear harvesting on the dissipation of fungicides applied during the low cropping periods, when the harvesting interval prolongs to 20-21 days. The present study was conducted to determine the residues of hexaconazole and copper in black tea, manufactured from shoots collected from a field under shear harvesting at an interval of 21 days.

A non replicated field trial was conducted in UPASI Tea Experimental Farm, Valparai (Tamil Nadu, India) situated at an elevation of 1050 m above MSL during November 2010 in the north east monsoon period. Plots measuring 100 sq.m contained tea plants of mixed cultivars, planted in double hedge. The treatments included a combination of hexaconazole 5 EC @ 200 mL/ha + copper oxychloride 50 WP @ 210 g/ha as one treatment (T1) and an untreated control (T2) for comparison as second treatment. The spray volume was 175 l/ha and applied with a hand operated knapsack sprayer. Tea shoots comprising three leaves and a bud were harvested by shear on "0" day (3 h after fungicide spray) and 21st day after the application of the chemical. Three sprayings were given at 7 days interval as per the blister blight disease management schedule. The harvested shoots were processed in miniature manufacturing unit. The drier mouth black tea samples were analysed for residues of hexaconazole and copper. Hexaconazole was analysed using gas chromatograph (Varian 3800) and copper content by using atomic absorption spectroscopy (AAS, Perkin Elmer Analyst A800). The methodology for hexaconazole residue analysis was that of Manikandan *et al.* (2006) and copper content was analyzed as per Official Methods of Analysis of AOAC International (AOAC 971.20, 18th edition). AAS was calibrated using NIST traceable copper standard solutions and the analysis was carried out at 324.8 nm resonance line.

Gas chromatographic analysis was carried out with Varian 3800 gas chromatograph coupled with thermionic specific detector using DB-608 column (Crossbond 50% phenyl-50% methyl poly siloxane). The operating conditions were as follows: detector temperature 260 °C, injector temperature 240 °C, oven temperature program, 1.0 min. at 190 °C, 5 °C/min. to 225 °C held for 8.0 min., 10 °C/min. to 240 °C held for 3.0 min. The

total running time was 20.50 min. The injection volume was 1.0 μ L. Nitrogen was used as the carrier gas and maintained at a constant flow rate of 3.0 ml/min. The approximate retention time of hexaconazole was 13.8 min. Method performance was assessed by evaluating quality parameters such as recovery percentage, repeatability, reproducibility, specificity, limits of quantification and detection. Linearity was achieved over the range of 0.1-0.5 mg/kg with a correlation coefficient of 0.999.

The residues of hexaconazole and copper content in black tea on "0" and 21st day are summarized in Table 1.

Table 1. Residues of hexaconazole and copper in black tea

| Days | Residues in mg/kg (T2) | | Residues in mg/kg (T1) | |
|------|------------------------|--------|------------------------|--------|
| | Hexaconazole | Copper | Hexaconazole | Copper |
| 0 | ND | 18.24 | 1.20 | 114.65 |
| 21 | ND | 18.12 | 0.21 | 40.21 |

ND-Non detectable

Limit for hexaconazole is 0.05 mg/kg

T2 -Untreated control; T1-Hexaconazole+Copper oxychloride (@200 ml+210 g/ha)

The results showed that the persistence of hexaconazole on 21st day was much higher (0.21 mg/kg) than its maximum residue limit of 0.05 mg/kg under European Union (EU). The copper content was on par with the EU MRL of 40.0 mg/kg and well below the MRL of 150.0 mg/kg prescribed by India. Manikandan *et al.* (2006) reported that after the combined application of hexaconazole and copper oxychloride, the residues of hexaconazole in black tea on 14th day was less than the detection limit when two sprays were given at 7 days

interval. It may be pointed out that in their experiment, harvesting was done by hand on 0,1,3,5,7,10 and 14 days after fungicide application. The frequent sampling resulted in faster dissipation of hexaconazole and the residue was less than the limit of quantification on 14th day. In the present study, fungicides were sprayed thrice, at 7 days interval and the sampling was done by shear harvesting on "0" and 21st day as per the recommended LET. The persistence of hexaconazole and copper on 21st day indicated that the accumulation of hexaconazole and copper oxychloride took place in the tender tea shoots. The study revealed that the impact of shear harvesting on the persistence of hexaconazole even on 21st day after three sprayings. This points to the need for a relook at the present schedule of fungicide application to control blister blight. This may necessitate the extension of spraying interval leading to reduction in the number of fungicide applications. But, the major disadvantage will be reduced level of blister blight disease control.

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