FIXATION OF MRLs IN TEA – INDIAN VIEW POINT

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Abstract

In general, only pesticides, (that include insecticides, acaricides, fungicides and herbicides) can be used on tea only after they have been statutorily registered by the Central Insecticide Board, Government of India. For registration purpose, the manufacturers of the pesticides need to generate data not only on bio-efficacies, but also those concerned with environment and the amount of residues of the active ingredients left on the tea after it has been processed.

Of late, because of the global concern on the toxicological and residual problems implicit in the use of pesticides, data on ADI, human toxicity as well as environmental toxicity are a must. Different countries, particularly the tea importing countries, have their own statutory regulations as to the amount of residues of pesticides and other toxicological attributes that they would permit. These requirements would vary obviously from country to country depending on their locatins, ecology and food habits of the people. Hence, the need for a convergence of different aspects of toxicological and residual attributes of pesticides, based on tea, is not only essential but is also an imperative.

A point to note here is that good agricultural practices can reduce the hazards of pesticides use on tea but diverse data specially on eco-toxicological aspects have to be generated over a period ot time before a consensus could emerge.

Against this perspective, the TMRC, MIP and MRL proposed by different countries have to be harmonized so that a unified concept emerges that would be acceptable to both importing and the exporting countries.

INTRODUCTION

Tea is a globally accepted wholesome and stimulating beverage. Its infusion in hot water contains caffeine, tannins, a few water-soluble vitamins, negligible quantities of carbohydrates and fat. Tea relieves body fatigue and has many other therapeutic properties as well. It is least known to cause any body ailments.

BACKGROUND

Every part of the tea plant is a potential target for a wide spectrum of pests and disease causing organisms which attack tender as well as mature parts of the plant like woody trunks and roots. Apart from direct loss in crop productivity, damage by certain pest, e.g. thrips, mites and caterpillars also affect the quality of the produce in varying degrees. The yield losses are primarily due to infestations by red spider mite (Oligonychus coffeae), purple mite, scarlet mite (Brevipalus phoenicis), yellow mite (Hemitarsonemus latus), pink mite (Acaphylla indica), red mite (Tetranychus telarius), leaf eating beetles (Seria assamensis), weevils, shoot mealy bugs, thrips (Scirtothrips spp. Taeniothrips setiventris, Haplothrips tenuipennis), tea mosquito (Helopeltis theivora), green fly, bunch caterpillar (Andraca bipunctata), psychid caterpillar (Clania spp), looper caterpillar (Biston suppessaria), red slug caterpillar (Eterusa spp), shot hole borer (Xyleborus fornicatus), termites and white grubs.

The fungal diseases virtually damage all parts of tea bush viz. root, stem and foliage. Important diseases include: blishter blight (Exobasidium vexans), black rot (Corticium theae), red rust (Cephaleuros parasiticus), bird's eye spot (Cerosporella theae), black root rot (Rosellina spp), red root rot (Poria hypolateritia), armillaria root rot (Armillaria mellea), wood rot (hypaxylon spp.), collar canker (Phomosis theae), die back (Leptothyrium theae), branch canker (macrophoma theicola), stem blight (unstallia aculeate).

Many weeds that grow in tea plantations; they include (i) grasses (paspalum spp., Panicum spp., Digitaria sanguinalis, Imperata cylindrical, Cynodon dactylong, Saccharum spontanum), (ii) hedges (cyperus rigidifolius), (iii) ferns (Pteridium equilinum, Nephrodium spp.,) (iv)mosses and (V) broad leaf weeds (borreria hispida, Borreria alata, Polygonum chinense, Mikania spp;, Mimosa spp., Agerogum spp., Oxalis acetosella, Commelina bengalensis, Solanum spp., Erechtites sp. Euphobia spp.). Among nematodes, the root knot nematodes (Meloidogyne spp.) are highly destructive to the roots of tea seedlings.

CONCEPT OF MAXIMUM RESIDUE LIMITS AND PRE-HARVEST INTERVALS OF PESTICIDES OF TEA

Tea planters use pesticides to control pest, diseases and weeds, which adversely affect growth and productivity of tea bushes. If not applied carefully in the plantations, pesticides damage mature bushes and more so in tea nursery. The use of pesticides is generally critically evaluated for the presence of residues on green and made tea. Normally, after application, pesticides residues dissipate with time, often ot a very low or non-detectable level. The potential hazards depend on the amount and toxicity of pesticide residues that remain on the crop, particularly on the leaves, which are plucked for manufacturing made tea. The level of the residue that remains on the leaves depends on the nature of the pesticide, growth of the plant, geographical area and various environemtnal conditions: possibly interactions of all these factors.

Since most pesticides are toxic, their continuous ingestion, even in micro quantities, can adversely affect human health. But, the use of pesticides can be regulated to ensure minimum residues remain on the food at a level that can be considered to eb safe for human consumption and environment as a whole.

REGULATORY ASEPCTS

To regulate and maintain pesticide residues at sate levels, Joint FAO/WHO Expert Committee on Food Additives (1995) and Codex Alimentarius Commission (1964) introduced the concept of safe level of pesticide residues in food staff. They recommended a Joint FAO/WHO Food Standard Programme for uniform implementation by all nations. The Commissions have laid down principles for aiming at the Maximum Residue Limites (Tolerance limits) of pesticide in fodd commodities. The recommendations are based on : (i) reports of the supervised trials designed to determine the maximum residues likely to occur on food through the applications of minimum effective dosage of pesticides to control pests and (ii) detailed toxicological studies with the parent compound and its major metabolites ot determine possible adverse effecs on animals. The main objective of the toxicological studies is to develop the Non-Observed-Adverse Effect Level (NOEL).

THE INDIAN STATUTORY POSITION

In India, 'Tolerance limits' (Maximum Residue Limits) are formulated by Central Insecticide Board adopted by a notification of PFA Authority for food items. For tea, tolerance limits of only

three insecticides (dicofol 5.0 ppm; ethion including its oxygen analogue 5.0 ppm and quinalphos 0.01 ppm) have so far been notified in the list under PFA Rules 1955, part XIV Insecticides and Pesticides. Metals covered under PFA Rules part XI Poisonous metals are lead (10 ppm) and copper (150 ppm). Under part XIV of PFA rules one mycotoxin (Aflatoxin 0.03 ppm) is also notified. At International level, CODEX standards are however very limited for tea. But, a list of about 190 pesticides has been identified and codified under EU Regulations very recently, though most of the MRL's mentioned in the list are at their limit of detection. In India, PFA is now attempting to fix tea for 15 pesticides MRL in.

METHODOLOGIES FOR RESIDUE DETERMINATION

A national protocol has been developed under supervised trials for 5 years and still continued. In this protocol all issues are considered like the dissipation of pesticide residue in tea following "Good Agricultural Practices" (GAP) under different agroclimatic conditions for fixing Maximum Residual Limit (MRL) and Pre-harvest Interval (PHI). The insecticides included are: acephate, chlorpyrifos, cypermethrin, deltamenthrin, dicofol, endosulfan, ethion, fenquinazin, malathion, monocrotphos, paraquat, phosphamidon, propargite and quinalphos. The data on dissipation of pesticide residue in tea have been generated by the supervised trials carried out at Tea Research Station, Tocklai, Assam; Borbetta, Assam; Nagrakata, West Bengal; Palampur, Himachal Pradesh; UPASI, Tamil Nadu following Good Agricultural Practices (GAP).

STEPS IN MRL DETERMINATION

The MRLs for a pesticide is calculated by taking into consideration the following data:

1. Non-observed-Adverse Effect (NOAEL): NOAEL is the highest dose of a pesticide in experimental animal studies that does not cause any detectable toxic effects. It is expressed in mg/kg body weight/day.
2. Acceptable Daily Intake ADI: ADI of a pesticide is the daily intake which during the entire life time appears to be without any appreciable risk to the health of the consumer on the basis of all the facts known at the time of evaluation of the pesticide. It is expressed as, mg/kg body weight/day.
   ADI = NOAEL/100
3. Food Factor: The proportion of different food commodities, which makes up a balanced diet for an average Indian. According to Codex Alimentarius Commission average consumption of cocoa, coffee and tea is 9.5 g/person/day. An average Indian drinks 5 cups of tea containing 2 g/cup of tea leaves. The total intake of tea per day is 10 g and food factor for tea = 10 g/1.5 Kg = 0.0067.
4. Maximum Permissible Intake (MPI)
   MPI = Acceptable daily intake x average body weight
5. Theoretical Maximum Residue Contribution (TMRC)
   TMRC = Daily consumption of the food commodity x residue in ppm
6. % of MPI: = TMRC/MPI x 100
7. Fixation of MRL: Fox fixation of a maximum residue limit, the values of TMRC and MPI are compared. If the values of TMRC is lower than the MPI, then the residues remaining on the crop under good agricultural practices are fixed as MRL on that crop.

PERSPECTIVE OF THE PROBLMES OF PESTICIDE RESIDUES IN TEA

Presence of pesticide residues, particularly above the accepted safe level (MRL), acts as anon-tariff barrier in the export of tea. Pesticide residues in made-tea produced in different countries are becoming a serious problem in view of the strict regulatory measures being adopted by EEC, Germany, Japan and many other developed countries in the world. The maximum residues limits (MRL fixed by FAO/WHO or EPA) are not acceptable to them, as these have not been fixed based on supervised field trials following good agricultural practices. If the residue data from field trials are not available, it is the general practice to fix the MRL at limit of detection, which in most cases, is extremely low and leads to the rejection of consignment. Council of European Communities has fixed the MRLs of many pesticides at their limit of detection, which would adversely affect the export of teas to the European countries.

THE MANDATORY ASPECT

It is now mandatory on the part of exporting country to generate the data for fixation of MRL's for different pesticides that are used on tea. Since tea is primarily grown and exported from India, the onus is on India to generate the required pesticide data to meet the statutory obligations of the importing countries.

Most of the MRL's of pesticides used on tea green or black (Made-tea) have been fixed on the basis of pesticide residues detected on tea ready of consumption or sale. However, made tea as such is not consued, but it is brew or decoction that is drunk. Therefore, it is not logical to study residues in the infusion or decoction. The transfer of residues from made-tea to infusion will depend on solubility of pesticide in water, its thermo-stability (many pesticides tend to degrade on heating), conjugation or binding of pesticides with plant substances etc. Hence, their is strong possibility that high residues found on made tea might not be transferred into the infusion. Studies carried out with some pesticides show that only 20-25% of the residues present on made tea pass into the infusion. Though, in case of some pesticides no residues could be detected in infusion e.g. paraquat, it is, otherwise seesntial that residues be determined in infusion for fixing the MRL.

INFERENCES

Judged against this perspective we would strongly urge that

1. Limits of residues of pesticides in tea should be set considering field data and degradation and metabolite studies only.
2. The levels set up in India are based on thorough scientific studies. Therefore, this databank can form a core for consideration while setting up MRL's for different pesticides at global level.
3. Indian data would reflect realistic situations since experiments are conducted in all extreme climatic conditions prevailing in the tea growing regions
4. GAP and use of pesticides in tea are highly regulated. Harmonization of limits globally in future is essential for the interest of trade under CODEX. Strategies need to be developed to work in that direction.