

Maximum Residue Limit (MRL) of Pesticides and their Global Significance

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ABSTRACT

Pesticides are a critical input in agriculture and have become a social need since they help to maintain food production and combat vector-borne diseases. In India, pesticide usage is 0.27 kg ha⁻¹, however non-compliance with waiting periods and pre-marketing treatment of food products has resulted in a huge residue problem in food products, which has hampered international trade. MRLs are established based on supervised agronomic field trials and toxicological research with the parent chemical and its primary metabolite. Food commodities are regulated in India by the Prevention of Food Adulteration Act (PFA) of 1954 (now the Food Safety and Standards Act (FSSA) of 2006), the insecticide act of 1968, and the Codex Alimentarius Commission, the Joint FAO/WHO Meeting on Pesticide Residues (JMPR), and the Codex Committee on Pesticide Residues (CCPR), among others. Other countries have their own agencies in charge of pesticide regulation and setting MRLs. MRL values for 213 pesticides have been set in India through 2021. The European Union, the United States, and Japan are India's main agricultural trading partners. Because developed countries are more concerned about food safety, they implement stringent regulatory measures that can operate as trade barriers. As a result, numerous Indian and other developing-country export shipments have been denied. The issues frequently occur as a result of the large variance in food quality requirements that exporters must achieve in home and international markets. Due to a lack of financial resources and knowledge, developing countries are unable to meet these requirements. To lessen the challenges encountered in international trade, appropriate agricultural practises must be promoted, as well as international collaboration on food safety standards harmonisation.

HIGHLIGHTS

- ❶ Non-compliance with waiting period resulted high residue in food
- ❷ Export product must be strictly regulated at farm level
- ❸ Awareness program about harmful incidence of pesticide should be regularly conducted

Keywords: Pesticides, Maximum residue limit, FSSA, JMPR, CCPR, safe use

Pesticides are commonly used in agriculture to protect crops from insects, fungi, and weeds, among other pests. Pesticides are hazardous by nature and do not distinguish between targeted and non-targeted species, thus they should be used carefully and responsibly (Ly *et al.* 2022). Pesticide residues have been found in excess in various parts of the world as a result of indiscriminate

and injudicious use, and the presence of pesticides in meals, fruits, vegetables, the environment, and even mother's milk is a serious worry. Because

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of its direct repercussions on human health and international trade, pesticide residue infecting food is a global issue. Residue analysis data from food monitoring programmes could be extremely useful in determining the potential dangers of pesticide exposure to human health and international trade (Gupta 2004; Anonymous 2002; Handa *et al.* 1999; Kraybill 1969). However, India's pesticide use is 0.27 kg ha⁻¹, but the injudicious use of persistent nature pesticides has produced a big problem in food commodities, causing international trade to be hampered (Statista 2021). A Committee was formed to obtain detailed information from the Ministry of Agriculture, the Central Insecticides Board, and the Registration Committee, which are the government agencies tasked with the registration, regulation, and use of pesticides in the country, due to the persistence of pesticide residues in food and agricultural products, as well as a lack of awareness on the part of farmers regarding the judicious use of pesticides. As per a note furnished to the Committee by the Ministry of Agriculture pesticides mainly enter into food products due to following reasons:

- ♦ Indiscriminate use of chemical pesticides
- ♦ Non-observance of prescribed waiting periods
- ♦ Use of sub-standard pesticides
- ♦ Wrong advice and supply of pesticides to the farmers by pesticide dealers
- ♦ Continuance of use of pesticides in Public Health Programmes
- ♦ Effluents from pesticides manufacturing units
- ♦ Improper disposal of leftover pesticides and cleaning of plant protection equipment
- ♦ Pre-marketing pesticides
- ♦ Fruit and vegetable pre-treatment

Many pests have evolved resistance to pesticides as a result of greater use. Farmers are forced to use more persistent pesticides and apply them more frequently as a result of this. As a result of all of these reasons, the environment has been contaminated, and pesticide residues in food have increased. Pesticide residue refers to any compounds found in food, agricultural commodities, or animal feed as a result of pesticide application. The term pesticide residue includes any derivative of a pesticide, such as conversion products, metabolic products, reaction products, and impurities considered to

be of toxicological significance (the term pesticide residue includes from unknown or unavoidable sources (e.g. environmental), as well as known uses of the chemical) (FSSAI 2020). However, one of the major challenges facing the country right now is how this pesticide residue amount is causing adverse effects on agricultural commodities and hampering agricultural productivity. In this context, Good Agricultural Practices (GAPs) for effective pest control have become necessary, and it has become necessary to set a certain limit for pesticide residues present in a food commodity in order to reduce losses in international trade, which is why the concept of MRL (Maximum Residue Limit) has been introduced.

MAXIMUM RESIDUE LIMIT (MRL)

The Maximum Residue Limit (MRL) is the maximum concentration of pesticide residue, given in mg/kg of the commodity, that is legally permissible in or on food and animal feeds as a result of pesticide use in accordance with Good Agricultural Practices (GAP). Under the joint FAO/WHO Food Standards Programme, the MRLs were established at the international level by the Codex Alimentarius Commission. Furthermore, each country sets its own MRL values; for example, in India, MRLs are determined by the Food Safety and Standards Authority of India, Ministry of Health and Family Welfare, GOI, under the Prevention of Food Adulteration (PFA) Act 1954 (now Food Safety and Standards Authority, FSSA, 2006). MRLs have been established for a variety of raw and processed food commodities. Foods can be of plant or animal origin, and they can be consumed by humans or animals. In India, 213 MRLs for various pesticides have been set till 2021. On the other hand, the Codex Alimentarius Commission has established 4844 MRLs for various pesticide/commodity combinations (FAO/WHO 2022).

Establishment of MRL

To determine the level of average residue that is likely to be present in food following the use of the pesticide in accordance with good agricultural practises, including all of the label instructions proposed for the product, extensive supervised residue trials must be conducted in several geographical areas during typical growing



periods of the year and confirmed to the farming practises of the region. To analyse residues from suspected abuse or misadventure, these experiments are conducted under maximum use settings, i.e. at the recommended application rate, maximum frequency of application, and often up to twice the recommended application rate. This gives you an idea of how much residue there will be in the worst-case scenario. The expected level of pesticide residue in individual foods or diets is compared to a health standard called Appropriate Daily Intake to ensure that the maximum residue limit is acceptable from a public health standpoint (ADI). On the basis of all known information at the time of evaluation of the chemical, the ADI of a chemical is its daily intake that can be eaten by an individual over a lifetime presumably without appreciable damage to the consumer's health. It is determined by toxicological studies conducted using specified test animals for at least two years in order to investigate the pesticide's overall spectrum of toxicity and set a No Observable Adverse Effect Level (NOAEL). The NOAEL is defined as the greatest dose level in mg residue/kilogramme body weight/ day that has no detectable effect on the most sensitive two or more test species, such as rats, rabbits, and pigs. The NOAEL, which is determined from long-term toxicological research, is used to calculate the ADI for humans by multiplying it by a safety factor of 10 to 1000, depending on the data available and any toxicological concerns. A safety factor of 10, 100, 1000 is considered for interspecies, intraspecies, and newborns in human beings. Typically, a safety factor of 100 is used. As a result, ADI (for humans) = NOAEL/Security factor It is measured in milligrammes of pesticide residue per kilogramme of body weight. When the ADI is multiplied by the average body weight of a man, which is usually 50 kg in India, the Maximum Permissible Intake (MPI) is calculated, which in this example is $ADI \times 50$ mg pesticide ingested per day/person. Furthermore, the Theoretical Maximum Daily Intake (TMDI) of the pesticide through a daily average diet of man can be calculated using extensive supervised trials conducted in a region as follows: Food consumed per day \times food factor \times maximum residue concentration found in raw food commodity from supervised trials In the preceding computation, the food factor is the percentage of the item in question in the consumer's overall daily diet, which is made up of a number of components. To

put it another way, the food factor determines the relative importance of each food in the overall diet. The National Institute of Nutrition in Hyderabad has developed food factors for people of all ages and sex groups in India. The MRL in question is now determined by comparing MPI to TMDI. When TMDI is less than MPI, the maximum residue contribution found in the food commodity during the supervised field trial is used to determine the MRL for that pesticide in the test crop. If the situation is reversed, the pesticide is deemed too dangerous for use on that crop. When four insecticides are sprayed on the same crop or one insecticide is sprayed on the same crop, the cumulative TMDI of the four insecticides or the same insecticide on different crops is considered, and if the cumulative TMDI is less than MPI, the maximum residue data is considered an MRL for that crop. Although each insecticide, or the same insecticide used in different crops, has its own MRL. Similarly, when controlled trials reveal that the residual level of a pesticide in a food commodity is below detectable levels, the MRL is set at the analytical method's minimum limit of detection. Furthermore, before validating the MRL, it must be determined that the sum of all pesticide residues from all food uses will not exceed the MPI by calculating projected dietary intake. This adds to the certainty that food safety is not jeopardised (WHO 2020, FSSAI 2021).

Pesticides regulatory framework in India

The MRL, which is defined in accordance with PFA/FSSR in a country, must be met by the sold food products. The FSSAI and state-appointed inspectors have the ability to evaluate products for conformance to the MRLs, both basic commodities and processed foods. FAS 2011 (USDA).

1. Prevention of Food Adulteration (PFA) Act 1954 and Rules 1955

The clause on the restricted use of insecticides is found in Rule 65 (Para-XIV) of the Prevention of Food Adulteration Rule, 1955, as well as Rule 65 (2), which states that the insecticides content must not exceed the tolerance level. The 'Maximum Residue Limits (MRLs),' formerly known as 'Tolerance Limits,' are regulated for several pesticides on food crops under Rule 65(2) of this act. It also calls for the State Central Governments to monitor



pesticide residues in food and feed, as well as soil and water, and to enforce tolerance limits. The 'PFA...(Amendment) Rules, 2004', as notified by the Ministry of Health and Family Welfare, Department of Health, New Delhi, on August 10, 2004, have been added to the act.

2. Insecticides Act, 1968 (IA) and Rules there under, 1971

The Government of India began enforcing the Insecticides Act and the rules enacted under it on August 1, 1971. Its principal goal is to prevent human and animal harm by regulating the import, manufacturing, sale, transportation, distribution, and use of pesticides. It should be noted that, despite its name, the Insecticides Act applies to all types of pesticides. This Act established the Central Insecticides Board (CIB) and the Registration Committee (RC), both of which are statutory entities. The latter is in charge of recommending the registration of new pesticides as well as prohibiting or restricting the use of older compounds that are deemed to be dangerous to humans at any given moment.

3. Joint Parliamentary Committee

On the 5th of August, 2003, the Centre for Science and Environment (CSE), a Delhi-based NGO, released a report on pesticide residues in soft drinks. Both internet and print media gave this report a lot of attention. Pesticide residues were identified in samples of 12 soft drink brands obtained from the open market in Delhi, according to the report. On August 6, 2003, the subject was also considered in the Lok Sabha. The members expressed grave worry about the discovery of pesticide residues in soft drinks and asked the government to provide an explanation after gathering all relevant information. After gathering the information, the Minister of Health and Family Welfare told the House that she would provide them to the House. Following that, the Minister made a statement in the Lok Sabha and lay it on the Rajya Sabha's Table on 21.8.2003. Members urged a JPC investigation after the Minister made her remarks in the House. JPC's creation was also approved by the Minister of Health and Family Welfare. At the conclusion of the debate, the Hon'ble Speaker declared that a JPC will be created and asked the Minister of Health and

Family Welfare to introduce a motion to that effect. As a result, on 22.8.2003, the Minister of Health and Family Welfare moved a proposal in Lok Sabha to establish a Joint Committee on Pesticide Residues in and Safety Standards for Soft Drinks, Fruit Juice, and Other Beverages, which was adopted the same day.

Recommendations of the JPC

The Committee discovered that there are numerous rules and regulations dealing with food safety standards in our country, as evidenced by the fact that there are numerous laws dealing with food legislation. As a result, various standard-setting entities have emerged, such the BIS under the BIS Act, the CCFS under the PFA Act, the Ministry of Food Processing under the FPO, the Ministry of Agriculture under 'AGMARK,' and so on. The Committee is deeply concerned by the fact that these bodies frequently work in isolation from one another, with little coordination. As a result of this predicament, the numerous laws have been loosely administered and enforced, with the end result that the consumer is the ultimate sufferer. A number of organizations/bodies/experts who spoke before the Committee expressed their concern in this regard. Almost all of them emphasised the importance of harmonising all existing laws and creating a single regulatory agency. The Committee notes that the Ministry of Food Processing Industries is already dealing with the matter, and that a group of ministers is looking into the full subject of an integrated food law and a single Authority. A Bill on the Modern Integrated Food Law has already been developed by the Ministry of Food Processing Industries, which serves the Group of Ministers. The bill establishes a framework for integrating existing food regulations in order to achieve more consistency and convergence in their regions of application. It also establishes an independent Food Safety and Standards Authority of India, tasked with assuring the availability of safe and wholesome food for human consumption by encouraging the use of science in the food business. Though this is a well-conceived idea that will help integrate various existing food laws, the Committee is disappointed to report that little progress has been accomplished thus far, as the Group has only convened twice since its formation. They therefore request that prompt



action be taken in this regard to conclude the Bill without further delay by making it a top priority, as it pertains to India's public health and food safety.

4. Food Safety and Standards Authority of India

India's Food Safety and Standards Authority will provide a regulatory framework for all aspects of the system, as well as notify standards and codes of practice, oversee capacity building, data generation for risk assessment and risk management, and provide technical assistance and an early warning system on food-related strategic issues.

For the goal of encouraging the manufacture, processing, and marketing of safe and healthful food, the Authority shall be required to:

- ♦ Commission scientific research necessary for the completion of its objectives
- ♦ Promote and coordinate the development of uniform risk assessment methodologies in the sphere of food manufacturing, processing, and sale
- ♦ Find, collect, collate, analyse, and summarise scientific and technical data on standard-setting.
- ♦ Take steps to detect and describe new dangers related to food consumption, as well as implement a quick alert system to monitor and send alerts about food-related health and nutritional issues.
- ♦ Create a framework of interconnected food-related organisations.
- ♦ Provide scientific and technical help to the federal government and state governments in the implementation of food safety crisis management protocols and the establishment of mechanisms for recalling contaminated or dangerous commodities.
- ♦ Provide scientific and technical assistance to the federal government and state governments in order to improve collaboration with international organisations in the areas of food manufacturing, processing, and distribution.
- ♦ Ensure that the public and interested parties receive timely, accurate, objective, and comprehensive information in the manufacture, processing, and sale of safe food by establishing maximum limits for the use of food additives,

as well as maximum limits for contaminants, pesticide residues, and veterinary drug residues.

- ♦ The coordination and supervision of the implementation of the provisions of this Act by formulating the procedures required from time to time to achieve the objects of this Act
- ♦ The collection of opinion and feedback from all parties involved in the food chain, generating awareness of food safety issues
- ♦ Notifying recognised labs and research institutions for the purposes of this Act after earlier publication of standards and recommendations in respect to articles of food intended for human consumption
- ♦ Notifying processes for the implementation of quality control and inspection in respect to commodities destined for export
- ♦ Notifying independent agencies for certifying industrial units that comply with food safety management systems
- ♦ Specifying the authorities for taking samples of any article of food, laying down guidelines for testing such samples by accredited laboratories, and subsequent follow-up of test results for appropriate action under this Act
- ♦ Promoting the procedure of industrial units self-compliance with the standards and food safety management systems
- ♦ Notification of the procedure for registering industrial units for the manufacture, processing, and sale of safe food, the authority empowered to register such units, the fees payable, the deposit of any sum as security for the performance of the conditions of such registration, and the circumstances under which such registration may be cancelled or security forfeited.
- ♦ Establishing guidelines to ensure better compliance with the standards and guidelines notified by the Authority under this Act by continuing to use existing staff and infrastructure in various Departments of the Government of India and State Governments dealing with various food laws, to the extent practicable.

5. Food Safety and Standards Act, 2006

It is an Act to consolidate the laws relating to food



and to establish the Food Safety and Standards Authority of India to lay down science-based standards for articles of food and to regulate their manufacture, storage, distribution, sale, and import, as well as for matters connected with or incidental thereto. No article of food shall contain insecticides or pesticide residues, veterinary drug residues, antibiotic residues, solvent residues, pharmacological active substances, or microbiological counts in excess of tolerance limits prescribed by regulations, according to Section 21: (1) of this Act.

6. Pesticide Management Bill, 2008

On October 21, 2008, the Rajya Sabha introduced the Pesticides Management Bill, 2008. The bill has been forwarded to the Standing Committee on Agriculture (Chairman: Shri Mohan Singh), which has three months to deliver a report.

- ♦ The bill aims to regulate pesticide manufacturing, quality, import, export, and sale in order to control pests, ensure the availability of high-quality pesticides, and reduce pesticide residue contamination of agricultural commodities. The 1968 Insecticides Act is repealed.
- ♦ "Pesticide" refers to any chemical or biological material used in the production, storage, or distribution of agricultural commodities or animal feed with the purpose of preventing or eradicating pests, such as undesired plants and animals.
- ♦ The central government will establish a Central Pesticides Board to advise the central and state governments on issues such as (a) preventing risk to humans, animals, and the environment during the manufacture, sale, and transportation of pesticides; (b) monitoring the performance of registered pesticides; and (c) reviewing the safety of pesticides.
- ♦ To manufacture, import, or export pesticides, the central government must establish a Registration Committee to (a) register pesticides after scrutinising their formulae and verifying claims made about efficacy and safety; (b) specify infrastructure requirements; and (c) specify protocols and good manufacturing practises for pesticide manufacture. Under the Food Safety and Standards Act of 2006, no

pesticide can be licenced unless its tolerance level for residues on crops and commodities is defined.

- ♦ If the Registration Committee determines that any provision of the Bill has been violated, the registration certificate may be suspended for a maximum of three months. It may also investigate the registrant's manufacturing or processing facilities and, if found insufficient, revoke the certificate.
- ♦ You have 30 days to appeal a refusal, suspension, or cancellation of your registration certificate to the central government.
- ♦ A licence is required for anyone who intends to manufacture or sell pesticides or conduct commercial pest control operations using pesticides. Licensing officials may be appointed by the state government to grant such licences in the prescribed manner. The officers must (a) keep a list of people who make or sell pesticides; (b) advise the state government on the performance of registered pesticides; and (c) inform the state government about the infrastructural facilities of manufacturers. The licence can be cancelled or suspended for a variety of reasons outlined in the law. The judgement can be appealed with the appropriate authority.
- ♦ Under a Direction, the central government can create a Central Pesticides Laboratory and accredit commercial laboratories to perform the same functions as the Central Pesticides Laboratory. Misbranded, spurious, or substandard pesticides, as well as any pesticide that violates the law, are prohibited from being manufactured, imported, or exported under the bill. If a pesticide isn't registered, it can't be sold, stockpiled, or utilised.
- ♦ Pesticide analysts and pesticide inspectors may be appointed by the central or state governments in the prescribed manner. A pesticide inspector has the authority to enter and search a premise if he has reason to believe that there has been a violation of the law; to seize the manufacturer's registers and records; to halt the distribution, sale, or use of pesticides with the permission of the Executive Magistrate; and to take samples of pesticides and send them for analysis by



a pesticide analyst within 48 hours. The bill also specifies the procedure that the pesticide inspector must follow when doing his duties. It also says that the pesticide analyst has 45 days to provide his findings.

- ♦ Any person who comes into contact with pesticides is required by the state authorities to report any poisoning incidents.
- ♦ The bill specifies a range of punishments for violations such as using pesticides illegally and selling misbranded or substandard pesticides.
- ♦ The state government may designate select courts of first-class judicial magistrates or a metropolitan magistrate as special courts for expedited proceedings.

AGENCIES AND REGULATIONS ON INTERNATIONAL TRADE

At the international level, various agencies are involved in the regulation of food commodities as well as nutritional levels, and the fixation of MRL is done through an appropriate channel by the following organisation with the following procedure:

1. Codex Alimentarius Commission

Under the Joint FAO/WHO Food Standards Program, the Codex Alimentarius Commission was established in 1963 by FAO and WHO to develop food standards, guidelines, and associated publications such as codes of practice.

- ♦ Protecting consumers' health is one of the program's key goals.
- ♦ Ensuring that fair trade standards are followed in the food industry

Pesticides have over 3200 MRLs specified by the Codex Alimentarius Commission (CAC).

CAC is assisted by—

- ♦ The Codex Committee on Pesticide Residues (CCPR)
- ♦ The Codex Committee on Residues of Veterinary Drugs in Foods (CCRVDF)
- ♦ The Joint FAO/WHO Meeting on Pesticide Residues (JMPR)

2. The Codex Committee on Pesticide Residues (CCPR)

The Codex Committee on Pesticide Residues (CCPR) is a Codex Alimentarius Commission (CAC) subsidiary that advises on all pesticide residual issues. Its main goal is to establish Maximum Residue Limits (MRLs) in order to protect consumer health while promoting international trade. By setting MRLs no greater than those arising from pesticide usage in conformity with Good Agricultural Practices, public health considerations are taken into account (GAP). The JMPR calculates maximum residue levels, and the CCPR makes MRL recommendations to the CAC's biennial conference.

3. The Joint FAO/WHO Meeting on Pesticide Residues (JMPR):

It is an independent scientific expert committee assembled by both the FAO and WHO Directors General in accordance with their respective guidelines. Its mission is to provide pesticide residue scientific recommendations. The WHO Core Assessment Group and the FAO Panel of Experts on Pesticide Residues in Food and the Environment make up the Joint Monitoring Panel on Pesticide Residues.

WHO Core Assessment Group:

- ♦ Reviews pesticide toxicological and related data
- ♦ Estimates pesticide no observed adverse effect levels (NOAELs)
- ♦ Defines Acceptable Daily Intakes (ADI) of pesticide residues in food for people
- ♦ Defines other toxicological criteria such as non-dietary exposures

The FAO Panel examines the situation:

- ♦ Pesticide use patterns (GAPs)
- ♦ Data on pesticide chemistry and composition
- ♦ Environmental fate (as it relates to pesticide residues in food and feed commodities)
- ♦ Metabolism in farm animals and crops
- ♦ Methods of analysis for pesticide residues, etc. for estimating pesticide MRLs in food and feed commodities

MRL is also set by countries, who derive their own national MRL based on resource availability,



expertise, and financial capacities in their respective countries. Various national agencies are involved in MRL fixing in their countries, including:

- ♦ India MRL: Food Safety and Standards Authority of India, Ministry of Health and Family Welfare, Prevention of Food and Adulteration Act, 1954 (currently Food Safety and Standards Act, 2006).
- ♦ Canada MRL: Pest Management Regulatory Agency of Health Canada
- ♦ America MRL: Food Quality and Protection Act of the United States Environmental Protection Agency
- ♦ Europe MRL: Directorate General for Health and Consumers of the European Commission
- ♦ International/CODEX MRL: Joint FAO/WHO Expert Meeting on Pesticide Residue under the Codex Alimentarius Commission
- ♦ Australia: Australian Pesticides and Veterinary Medicines Authority

INTERNATIONAL TRADE – INDIAN SCENE

India is one of the world's fastest developing economies and is currently attracting a lot of international interest. In terms of geographical size, it is the world's fifth largest country. India's agriculture is vast and diverse, and it is one of the world's main producers. With an ever-increasing population to feed, it is also a key consumer. As a result of this, as well as its agricultural and trade policies, its global market influence has been limited in comparison to the scale of its agriculture. India is still a relatively unknown country. While it has been a tiny net agricultural exporter since 1990, substantial changes in its agriculture and trade policy, as well as considerable changes in its net trading position for many particular goods, have occurred in recent years. India is expected to play a larger role in global markets in the future, according to top forecasting agencies. It is projected to strengthen its position as one of the world's major importers (vegetable oils) and exporters in a number of markets (rice). Given the magnitude of Indian agriculture, changes in its commodity balance sheets could have a significant impact on global markets (SAWTEE 2005; Yadav 2010; Financial Express 2005; Current News 2008; The Times of India, 2010; AGRIS

2010; Zee News 2010; The Economics Times 2019). Cereals contribute the most in terms of quantity and value of all agricultural goods exported. Milled rice is the single most important export, accounting for 16 percent of total export value in 2003-2005. Cotton and wheat, two other commodities, are also among the top ten exports. Soybean meal, an intermediate product, is the country's second-largest export, accounting for 9% of total sales. The value of exports changed dramatically in the 1990s. This illustrates large changes in both the price and volume of rice exports, with the latter relying on the production-consumption balance. Despite these swings, India's exports have gradually increased since 1999. Exports of beef (buffalo meat) and soybean meal, in addition to rice, are increasing.

International trade is at risk

1. Rejection of chilli consignments from India

Aflatoxin, a food contaminant, has a zero tolerance threshold in the United States. As a result, a few consignments of chilli and chilli products from India were rejected. In Europe, the MRL for aflatoxin is 0.01 ppm. The European Commission (EC) announced on April 4, 2005 that the presence of Sudan dyes in food products is prohibited due to their carcinogenic nature. Italy rejected an Indian shipment of crushed hot chilli containing the illegal colours Sudan 1 and Sudan 4 in June 2005. The EU rejected 12 Indian food shipments in June, while the US rejected 216 Indian shipments.

2. Rejection of okra from India

The EU rejected an okra shipment from India because pesticide traces exceeded the MRL. Monocrotophos and Acephate were 0.13 ppm in the exported shipment, whereas triazophos was 0.11 ppm. Monocrotophos has an MRL of 0.2 ppm in India, and the other two pesticides are not recommended for use on okra. Monocrotophos, acephate, and triazophos each have EU MRLs of 0.05, 0.02, and 0.01 ppm.

3. Rejection of Indian grapes

Different MRLs in exporting countries are hampering the Indian Ministry of Commerce and Industry's drive to raise grape exports from 37,000 to 44,000 tonnes. Indian grapes have a limited export season,



lasting approximately six to seven weeks. A impasse induced by chlormequat, one of 98 pesticides tested on grape consignments to the EU, posed a threat to exports to the EU. In mid-April 2010, the European Union banned table grape shipments containing chlormequat chloride, a Plant Growth Regulator. Chlormequat chloride (lihocin) has an MRL of 0.05 mg/kg in the EU. Different MRLs in exporting countries are hampering the Indian Ministry of Commerce and Industry's drive to raise grape exports from 37,000 to 44,000 tonnes. Indian grapes have a limited export season, lasting approximately six to seven weeks. A impasse induced by chlormequat, one of 98 pesticides tested on grape consignments to the EU, posed a threat to exports to the EU.

4. Pesticide residue problem in rice

Basmati rice is mostly imported by European countries. The EU rejected a shipment of Basmati rice due to isoprotiolane pesticide levels. Finland turned down an organic rice shipment from India. Pesticide residues of inorganic bromide 23 mg/kg were found in a shipment of organic long grain aromatic rice. Wooden pallets used to ship organic products were treated with methyl bromide, which is banned under organic standards all over the world. Due to an increase in the level of tricyclazole (0.1 mg kg⁻¹) in the edible portion of Indian Basmati rice, the European Union reduced imports by up to 1.62 lakh tonnes from April to December 2018. During April-December 2018, India's basmati exports to the EU fell by nearly 60% compared to the previous year, reaching 1.62 lakh tonnes. As a result, basmati rice exports decreased by 60% in comparison to the previous year.

5. Pesticide residue in tea

Teekanne, the Indian market leader, had a delivery of Darjeeling gold tea denied in Germany in 1995 because the tea leaves contained excessive amounts of illegal pesticides. The insecticides tetradifon and ethion were found in substantially higher concentrations in the tea leaves than Germany's MRLs. Interestingly, different countries' MRLs for the same herbicide vary dramatically. The rejected tea consignment, for example, included 0.24 mg of tetradifon per kilogramme of tea. This was 24 times Germany's fixed MRL. On June 30, 2000, officials

from the EU Health and Consumer Protection Bureau announced the new EU Act 2000 42EC. The Maximum Residue Levels (MRLs) for several pesticides were changed as a result of this act. The EU implemented new 134 MRLs for pesticides in tea products on July 1, 2001. The new EU Food Safety Act has had a substantial impact on the world's main tea exporters, as seen by the drop in export volume. According to quantitative study, tea exports have decreased by 61.6 percent after the MRL was dropped to a 5% significance threshold.

6. Rejection of toxic wheat from Australia

Australia shipped 1250 tonnes of poisonous wheat to India. The shipment contained 0.07 ppm of chlorpyrifos, which was higher than the Indian tolerance. The MRL in India is set at 0.05 ppm, while the MRL in Australia is set at 0.5 ppm.

Problems in international trade

- ◆ There is a significant gap between the food quality criteria that Indian businesses must fulfil in order to reach domestic markets and those that they must meet in order to access international markets.
- ◆ The majority of developed countries have implemented stringent food safety regulations that take into account health and hygiene concerns.
- ◆ Differences in technology adoption: some developed countries use the HACCP (Hazard Analysis Critical Control Points) method to monitor and maintain food safety standards, whereas others, such as Japan and the United States, use an ASTA (American Spice Trade Association) analytical method to monitor and maintain food safety standards.
- ◆ Stricter pesticide residue standards have severe negative effects on trade in developing countries, resulting in a significant decrease in the export of food and agricultural products from developing countries.
- ◆ Even if such standards are adopted, most producers and exporters fail to incorporate such standards in their production process due to limited financial capacity and expertise.
- ◆ International harmonisation of MRL does not exist at a global level.



- ♦ Even though the Codex Alimentarius contains defined levels, they are not statutory.
- ♦ National authorities have the authority to set these limits. As a result, these legal limits can differ significantly from one country to the next.

CODEX MRLs

Codex-MRLs are safety standards that are developed after a risk assessment. The World Trade Organization has designated these as an international benchmark in the context of the Agreement on the Application of Sanitary and PS Measures. National MRLs have taken the place of codex MRLs. If a commodity isn't grown in a country, the MRL is automatically set to the detection limit. The codex MRL is commonly adopted by developing countries, whereas developed countries set their own national MRL that is lower than the codex MRL. However, when countries have food safety trade disputes, the Codex standards are used as reference standards.

HARMONIZATION OF MRL

International organisations such as the FAO, WHO, CCPR, and the OECD are strongly supporting the increasing trend of harmonising MRL in each region or internationally. MRLs in the EU have been standardised since the beginning of September 2008, thanks to the new EC No. 396/2005 regulation. Africa has also begun an initiative to harmonise global MRLs, which is being funded by the US Department of Agriculture. India has taken the initiative to collect field residue data on pesticides in tea and submit it to Codex. For the purposes of determining MRL, data for chlorpyrifos and paraquat have been accepted at the international level. MRL harmonisation pilot project - In this project, the CCPR will build a process for novel chemicals that will allow Codex MRLs to be established before national MRLs are established.

CONCLUSION

Pesticides are used to protect crops when used in the recommended dose, but they have developed resistance in pests as a result of excessive and injudicious use, which has led to the use of higher doses of pesticides in food commodities to protect the crop, and this excessive use has resulted in higher residue levels in food commodities, which

has hampered international trade, which is why it has become necessary.

1. To raise awareness of a forbidden pesticide's use in a food product.
2. Growers in importer or exporter countries should know which pesticides (registered) to use.
3. Harmonization of MRL values across nations is required.
4. Surveillance of the domestic market to ensure food safety. Availability of high detection instrumentation facility and adoption of universal method for testing and analysis.
5. For important export food commodities, web-based software such as Grapenet (created by APEDA, the Agricultural and Processed Food Export Development Authority) should be established.
6. Retailers' licences will be revoked if they seek to sell pesticides that are prohibited.

In a nutshell, proper knowledge among farmers about the severe consequences of using banned or excessive pesticides should be disseminated, and regular surveillance of field as well as market food commodities should be present, and to export the commodities, all necessary data related to quarantine should be generated and made available on web-based software (such as grapenet in the case of grapes) so that only that country should be able to export the commodities.

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