



COMMISSION ON PHYTOSANITARY MEASURES

EIGHTEENTH SESSION

IPPC SURVEY ON ANTIMICROBIAL PRODUCTS USED IN PHYTOSANITARY CONTEXT

AGENDA ITEM 16.2

(Prepared by the IPPC Secretariat)

Background

- [1] In 2023, CPM-17 requested that the secretariat represents the Commission on Phytosanitary Measures (CPM) at the FAO One Health meetings, share information about ongoing relevant International Plant Protection Convention (IPPC) initiatives at those meetings, and keep the CPM Bureau informed on developments on the subject that may impact the CPM or require CPM awareness or action.
- [2] FAO¹ defines antimicrobial resistance (AMR) as the ability of microorganisms to persist or grow in the presence of drugs designed to inhibit or kill them. These drugs, called antimicrobials, are used to treat infectious diseases caused by microorganisms such as bacteria, fungi, viruses and protozoan parasites. Antimicrobials play a critical role in treating diseases of food-producing animals (aquatic and terrestrial) and to a lesser degree in plants, helping to ensure food security.
- [3] Antibiotics and fungicides are widely used to prevent, control or treat disease in humans, animals and plants. Still, many reports discussing antimicrobial resistance in agriculture are entirely about antibiotic use in a veterinary setting and only mention plant crop production and protection at the margin. Furthermore, these reports often combine antibiotic resistance with antimicrobial resistance in general, which for plants would logically include fungicides.
- [4] Considering the need to raise the profile of plant health in the overall One Health debate and to determine the extent of antimicrobial products usage for plant health, the CPM-17 (2023) requested the International Plant Protection Convention (IPPC) secretariat to explore the suitable approach for a study aiming to better understand the nature and scope of risks associated with AMR in the phytosanitary context, including resistance to fungicides.

Survey Methodology

- [5] In order to fulfill the CPM request on the AMR survey, the IPPC Secretariat developed a brief survey in two phases through the IPPC Observatory to gather information from countries on the antimicrobial products used in plant production and protection.
- [6] To simplify the understanding of this complex topic, the Secretariat opted for a two-phase approach, firstly collecting data on the antimicrobial products used by countries, and secondly studying resistance linked to

¹ FAO AMR webpage: <https://www.fao.org/antimicrobial-resistance/background/what-is-it/en/>

the use of antimicrobial products in plant protection. The results presented in this paper only concern the first step on the use of antimicrobial products collected as of February 5, 2024.

- [7] The survey tool used was the Microsoft Forms, with questionnaires translated in all the six UN official languages and an attached word version of the survey was provided in the distribution e-mail. Regular reminders were made by the IPPC Mass email and announcements were published to remind the survey's deadlines.
- [8] The first AMR survey was on the use of antibiotic products in plant protection with five questions seeking information about the specific list of 11 antibiotic products utilized for plant protection, the crops they are applied to, the targeted pests, the quantities involved, and the types of production areas where they are deployed. The antibiotics survey was conducted from May to December 2023; and extended to February 2024.
- [9] The second AMR survey was on the use of fungicides in plant protection to identify the most used fungicide products, on which crops and pests. As the number of fungicides references in plant protection is significantly higher than antibiotics, a compiled list of 74 fungicides was established to simplify the survey. The fungicides survey was conducted from October to December 2023; and extended to February 2024
- [10] The IPPC contact points were encouraged to liaise with the appropriate institutions, including customs, pesticide registration and regulatory agencies, and pesticide sellers to gather the needed information. Regular reminders were sent through the IPPC Mass email and the IPP (International Phytosanitary Portal) announcement.
- [11] The results of the two surveys were compiled and a preliminary report was generated to provide an overview on the antimicrobial products use in plant protection and production.
- [12] To preserve the confidentiality of the information submitted by the respondents, no country name is specifically identified in the results which are analyzed by region and the data considered are only those transmitted to the IPPC by the countries as part of this survey.

Outcomes of the 2023 SPG and Bureau meetings

- [13] In June 2023, the preliminary results of the IPPC Observatory survey on antibiotics use in plant protection were presented to the CPM Bureau. The Bureau noted the preliminary results and the IPPC secretariat's plan to extend the survey's deadline to increase the response rate and later present the survey results to CPM. The Bureau also agreed that fungicides and antibiotics should be addressed separately when gathering data on antimicrobial products, with care taken to be explicit about the intended meaning when the term "antimicrobial" is used.
- [14] In October 2023, the CPM Bureau noted the results of the IPPC Observatory survey on antimicrobial resistance; and encouraged that the FAO statistical unit provide support for current and future surveys.
- [15] SPG 2023, noted that, so far, there was insufficient evidence to determine where AMR may exist in the plant-health arena. More data needed to be gathered. The CPM chairperson noted that this should be highlighted at CPM-18 (2024).
- [16] The EPPO representative drew the attention of the SPG to the EPPO Database on Resistance Cases, which included data on fungicides although not on antibiotics and confirmed that the database only related to Europe.
- [17] The SPG also noted the value of conducting systematic search of literature. The IPPC secretary clarified the survey's intention was only to evaluate the usage level. The next step would be to validate the data by

gathering more information from the respondents who had indicated that they registered or used antimicrobial products.

- [18] The IPPC secretary clarified that an assertion had been made in certain circles that the use of antimicrobials in plant protection was contributing to AMR in a One Health context. The purpose of this IPPC survey and other related analyses was to gather evidence that may or may not support that assertion.
- [19] The SPG welcomed the expansion of the AMR survey to fungicides and noted that fungal infections affected human and plant health, although fungicides were not commonly used in animal health.

Key findings of the antimicrobial use (AMU) surveys

- [20] The main objective of the survey was to gather information from the IPPC community to better understand the nature and scope of risks associated with AMU in plant protection.
- [21] This first phase, focusing on antimicrobial use, provides basic information that contribute to determine trends.
- [22] Data provided by the countries on the use of antibiotics survey shows that among the seventy-six (76) respondents, only 32% confirmed the use of antibiotics in plant protection. The products most frequently cited were Kasugamycin (23,7%) and Streptomycin (25%), and although these products are used for bacterial diseases on a wide range of crops, they were mainly used on tomato, rice and potato.
- [23] The detailed analysis of the survey's results is presented in Appendix 1.
- [24] This information tends to put into perspective the presumed important contribution of plant health to antimicrobial resistance. In fact, almost 70% of respondents do not use antibiotics for plant protection, and the estimated quantities for those using are modest compared with the overall use of antibiotics.
- [25] These survey results are consistent with the recent (January 2024) FAO publication on “ Tackling Antimicrobial Resistance in Food and Agriculture”² which confirmed that in addition to its direct impact on human and animal health, AMR poses certain risks to food and agricultural systems, food safety, food security, livelihoods and economies. It is estimated that more than 70 percent of all antimicrobials sold worldwide are used on animals raised for food (Van Boeckel *et al.*, 2017).
- [26] As for the survey on the use of fungicides, forty-seven (47) countries provided information on the products used, and the ten (10) most widely used products in terms of quantity are Mancozeb, Azoxystrobin, Copper, Sulfur, Chlorothalonil, Metalaxyl, Carbendazim, Fostyl -al, Propiconazole and Thiophanate-methyl.
- [27] The detailed analysis of the survey's results is presented in Appendix 2.
- [28] Fungicide use and resistance to fungicides is an important issue, however it is a separate one to antibiotic use and antibiotic resistance.
- [29] At this stage, even if the response rate is considered relatively low and therefore should be considered with caution, the preliminary results show that the number of countries using antimicrobials in plant production and protection is relatively low.
- [30] However, a follow up survey, coupled with a more in-depth analysis, which is to take place as part of the second phase of the study, would be useful in ascertaining the extent to which the use of these products at these amounts contribute to the overall AMR challenge.

² Tackling Antimicrobial Resistance in Food and Agriculture:
<https://www.fao.org/documents/card/en?details=cc9185en>

Recommendations

[31] The CPM is invited to:

- (1) *note* the preliminary results of the IPPC Observatory surveys on antibiotics and fungicides used in plant protection.
- (2) *thank* the countries respondents for the two surveys for their contributions to better understanding of the antimicrobial use in plant health.
- (3) *request* the IPPC Secretariat to extend the two surveys and strongly *encourage* countries that have not yet responded to the surveys to do so in order to obtain representative data of the IPPC community.
- (4) *agree* that the study on antimicrobials is extended to analyse of antimicrobial resistance and that the necessary resources should be allocated for this purpose.

APPENDIX 1: Preliminary results of the survey on antibiotics use

a) *Use of antibiotic products in plant protection*

[32] The results presented in the paper reflect data received by the IPPC Secretariat up to the deadline of 05 February. By this date, seventy-six (76) countries responded to the survey on antibiotics.

Table 1: Regional distribution of respondents for survey on antibiotics use

Regions	<i>Africa</i>	<i>Asia</i>	<i>Europe</i>	<i>Latin America and Caribbean</i>	<i>North America</i>	<i>Near East</i>	<i>Pacific</i>
N° of respondents	31	10	16	10	1	5	3

[33] These initial results highlight that **67.10%** of responding countries (51) do not use antibiotics in plant production and protection.

[34] Twenty-five of the respondents have declared that they use antibiotics (32,83 %) in plant protection (Seven in Africa, eight in Asia, eight in Latin America and Caribbean, one in North America and one in Pacific).

[35] **Table 2:** List of the most used antibiotics

Antibiotics	Positive responses	% total respondents
Kasugamycin	18/76	23,7%
Streptomycin	19/76	25%
Tetracycline	7/76	9,2%
Oxytetracycline	10/76	13,2%
Gentamicin	8/76	10,5%
Validamycin	8/76	10,5%

[36] Figure 1 also shows that Kasugamycin (23,7%) and Streptomycin (25%) are most antibiotic products in plant protection.

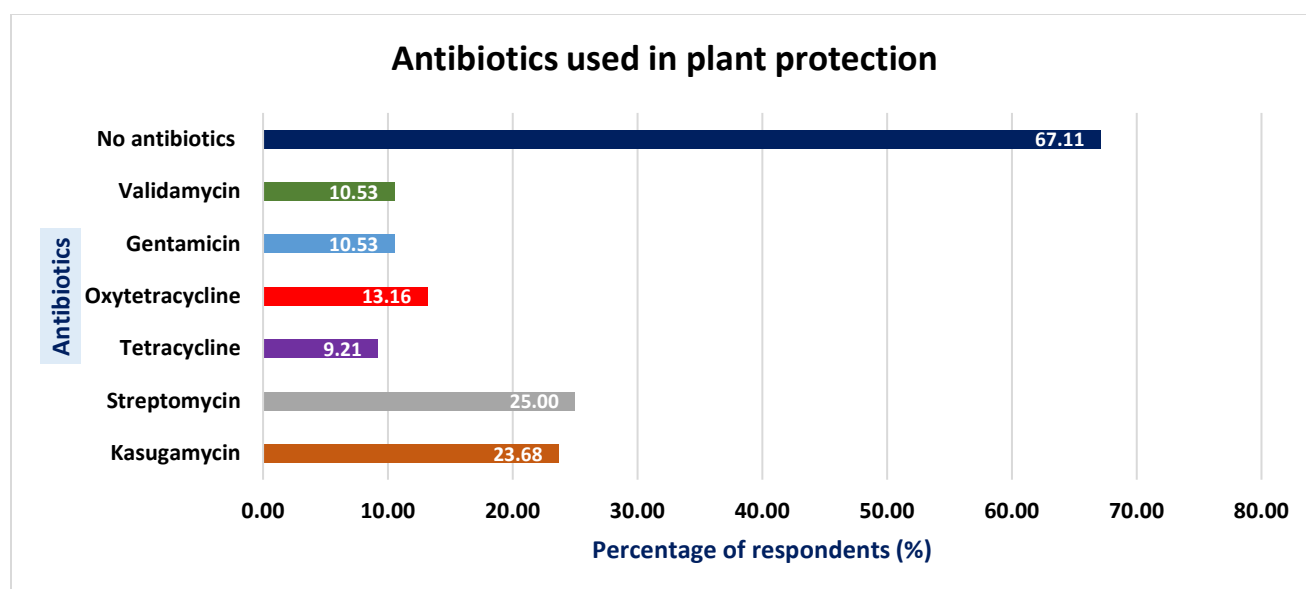


Figure 1: Rate of antibiotics use for plant protection.

b) *Crops targeted*

[37] The countries reported the use of antibiotics on a wide range of plant crops. These products are mainly vegetables and fruits such as rice, potato, lemon, pepper, garlic, apple, pear, kiwi, cabbage, tomato, etc.

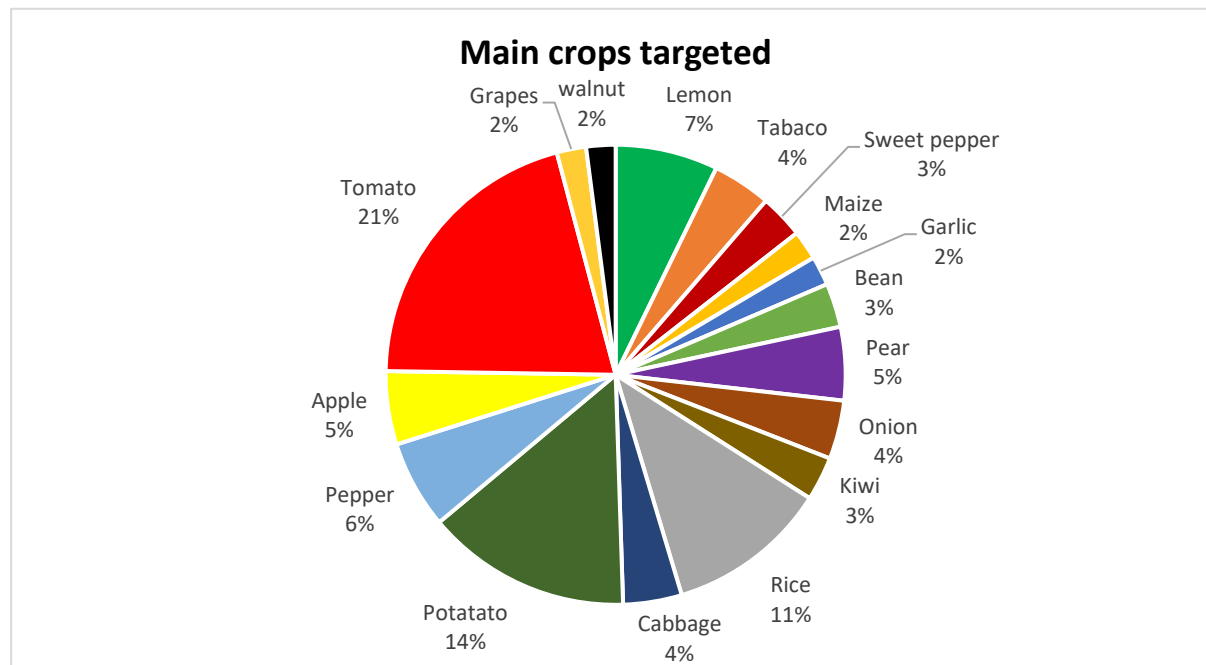


Figure 2: Crops on which antibiotics are most used.

[38] According to Figure 2, tomato, potato and rice are the three main crops on which antibiotics are used.

[39] For example, Kasugamicin is used on rice (*Oryza sativa* L.), tomato (*Solanum lycopersicum* L.), potato (*Solanum tuberosum* L.) and Streptomycin is used on sweet pepper (*Capsicum annum* L.) tomato (*Solanum lycopersicum* L.) and tobacco (*Nicotiana tabacum* L.).

c) **Pests targeted.**

[40] The antibiotics used in plant protection are mainly for bacterial diseases such as bacterial soft rot (*Pectobacterium* sp.), fire blight (*Erwinia amylovora*), bacterial canker (*Clavibacter michiganensis*), bacterial spot (*Xanthomonas campestris*), bacterial fruit blotch (*Acidovorax avenae* subsp. *Citrulli*); although some cases of use have been mentioned against fungal diseases and harmful insects.

[41] These antibiotics are used alone to manage the targeted disease. For instance, Kasugamicin is used to manage pests such as *Clavibacter michiganensis*, *Xanthomonas* sp., *Pseudomonas* sp. or *Erwinia* sp. They are also used in combination such as Streptomycin and Oxytetracycline to deal with *Agrobacterium tumefaciens*; *Pseudomonas* sp.; *Xanthomonas* sp.; *Erwinia* sp. or Gentamicin and Oxytetracycline to manage *Clavibacter michiganensis* subsp. *michiganensis*.

[42] Some countries have declared that although there is no effective use, certain antibiotic-based products are registered for plant protection. For example, pesticides containing Validamycin are registered for about 30 crops, mainly vegetable crops.

d) **Quantity used**

[43] Based on data provided by respondents, quantities of antibiotic products used per year varies significantly on the level the agricultural production in the country.

- [44] The estimated quantities ranged from **0.32 to 566 t / year** with an average around 64t / year.
- [45] Considering the FAO³, report on the use of pesticides at the global level, which indicates that pesticide usage has almost doubled between 1990 and 2018, going from 1.7 to 2.7 million tons, the use of antibiotic products reported in this survey represents seems modest.

e) ***Kind of areas of production***

- [46] The Figure 3 highlights that 80% of antibiotics in plant protection are mainly used to manage plant diseases in field and in greenhouse.

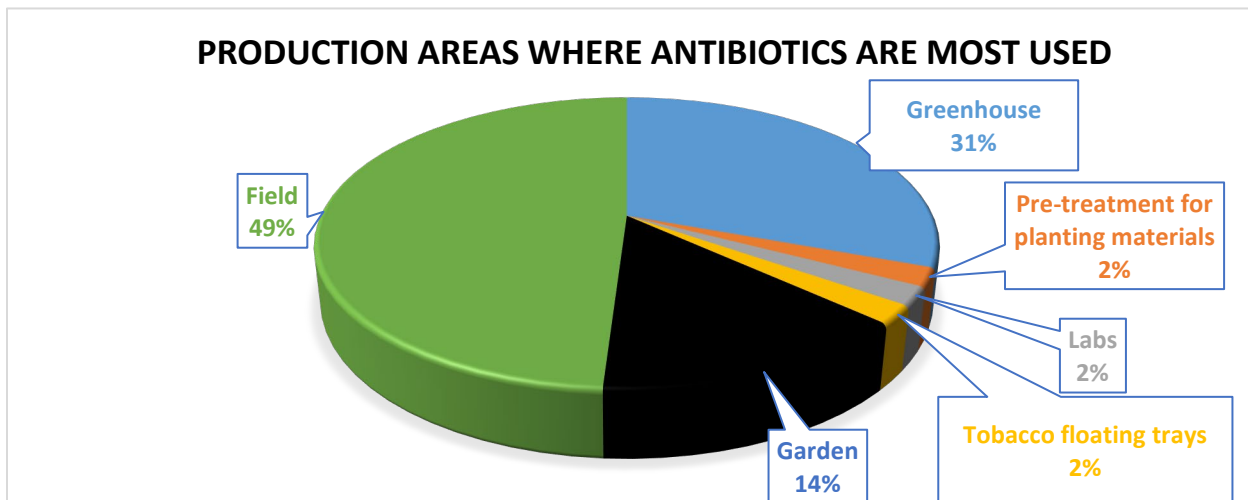


Figure 3: Production areas where antibiotics are most used.

³ FAOSTAT : <https://www.fao.org/faostat/en/#data/RP/visualize>

APPENDIX 2: Preliminary results of the survey on fungicides use.

a) *Use of fungicides in plant protection*

[47] The results presented in the paper reflect data received by 07 February 2024. Forty-seven (47) countries responded to the survey on fungicides as follow:

Table 3: Regional distribution of respondents for survey on fungicides use

Regions	Africa	Asia	Europe	Latin America and Caribbean	North America	Near East	Pacific
N° of respondents	11	5	10	11	1	6	3

[48] All the respondents confirmed the use of fungicides in plant protection.

[49] The first question of the survey asked the respondents to check the appropriate boxes to indicate products used for plant protection in their countries. Table 4 presents the ten (10) most cited fungicides based on the respondent's selection.

Table 4: List of the most used fungicides.

Fungicides	Positive responses	% total respondents
<i>Metalaxyl</i>	40/47	85,5%
<i>Azoxystrobin</i>	39/47	82,9%
<i>Copper</i>	38/47	80,9%
<i>Sulfur</i>	36/47	76,6%
<i>Mancozeb</i>	33/47	70,2%
<i>Boscalid</i>	32/47	68,1%
<i>Dimethomorph</i>	32/47	68,1%
<i>Chlorothalonil</i>	30/47	63,8%
<i>Captan,</i>	29/47	61,7%
<i>Propiconazole</i>	29/47	61,7%

[50] Figure 4 below presents the 10 most used fungicides for plant protection in countries.

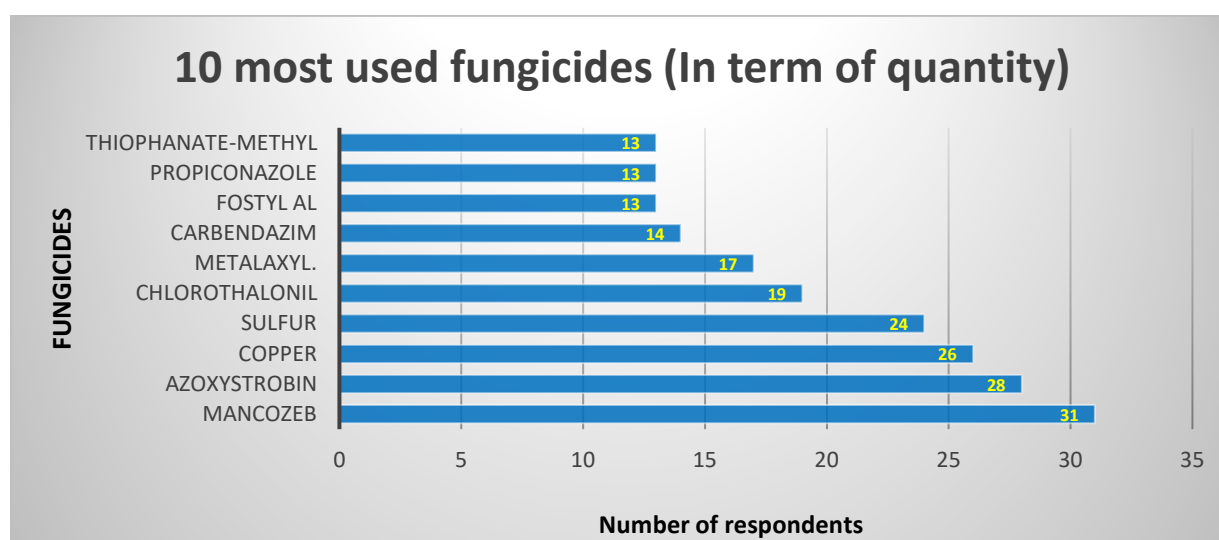


Figure 4: The 10 most used fungicides in terms of quantity.

[51] The results show that the following fungicides: Metalaxyl, Azoxystrobin, Copper, Sulfur, Mancozeb, Chlorothalonil and Propiconazole are listed in the top 10 of the most frequently cited from the list of 74 fungicides and in the top 10 of most used in terms of quantity.

a) *Crops targeted.*

[52] Fungicides are part of one of the groups of pesticides most used for plant protection on a very wide range crops such as tomato, potato, garlic, onion, cabbage, cucumber, apple, pear, peach, grapes, apricot, carrot, olive, tobacco, citrus, pumpkin, chard, flowers etc.

[53] The table 5 below presents some examples of crops on which the fungicides mentioned are used.

Table 5: Plant crops on which these fungicides are used.

Fungicides	Crops
Mancozeb	Tomato, potato, cabbage, onion Onion, kiwano, Corn, Melon, Potato, cucumber, Pineapple, sambo, watermelon, pumpkin, Cocoa, Rose, grape, bean, Pepper, banana, avocado, almond, apricot, banana , broccoli, cabbage, pepper , carrot , celery , cherry ,citrus ,bean, cotton , cucumber...
Azoxystrobin	Zucchini, potato, bean Rice, Potato, Banana, Fruit Trees, Tobacco...
Copper	Potato, tobacco, banana, fruit trees, coffee, cocoa, grains...
Sulfur	Zucchini, vine, peas rice, banana, pitahaya, rose, grape, watermelon, kidney tomato, bean, melon, potato, broccoli...
Chlorothalonil	Tomato, zucchini, potato, peas Potato, Banana, Garlic, Onion, mango, papaya, plantain, onion, banana, rice, potato, cocoa...
Metalaxyl.	Tomato, potato, cabbage, onion...
Carbendazim	cucurbits, legumes, lettuce, sunflower, rice, fruits
Fostyl -al	Tomato, apple tree, potato potato, kidney tomato, rose, onion, cocoa, papaya
Propiconazole	Plantain, rice, onion. Tetraconazole: rice, potato, corn, beans, soy, coffee, tomato.
Thiophanate-methyl	Apple, citrus,grape,wheat, cabbage, lettuce, strawberry watermelon...

b) *Pests targeted*

[54] The fungicides mentioned are used against a wide spectrum of diseases. Table 6 presents some examples.

Table 6: pests targeted by these fungicides for plant protection

Fungicides	Pests
Azoxystrobin :	<i>Phytophthora infestans , Alternaria solani, Stenphilium solani, Pyricularia grisea , Sarocladium oryzae...</i>
Chlorothalonil :	<i>Phytophthora , Alternaria , Mycosphaerella..</i>
Copper :	<i>Phytophthora , Alternaria ,Cercospora , Mycosphaerella...</i>
Dimethomorph :	<i>Phytophthora , Peronospora...</i>
Mancozeb :	<i>Phytophthora , Alternaria ,Cercospora , Mycosphaerella , Peronospora...</i>
Propiconazole :	<i>Alternaria ,Cercospora , Mycosphaerella...</i>

c) *Quantity used*

Quantities of fungicides used per year vary by even wider proportions than that observed for antibiotics. The estimated quantities vary from **35 Kg to 10.000.000 t / year** with an average around 250.000 t / year based on provided information on annual use.