全国高等农林院校“十一五”规划教材

植物保护专业英语

何月秋　尹新明　主编

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前　　言

科学技术真是日新月异，以致没有一个人敢说自己能拥有太多的新知识。事实上，每个在科学上不满足的人，都会认为自己在快速进步的科学面前是非常渺小的。要使这种渺小不至于使我们成为愚人，我们不得不每天注意学习新的东西、新的知识。但许多先进技术和知识多以英语为载体而传播，尤其是一些带前沿性的重大科技进展多数是在英文杂志上发表的；另一方面，不用讳言，英语成为一种国际性的交际工具已成为事实。因而，要想从这些科技进步中取得先进的知识，必须提高专业英语能力。然而，专业英语与日常英语有很大差异，主要表现在专业词汇量特别大，且专业词汇有自己的特点，有些日常英语在专业上亦常赋予不同的用法和含义；在语言表达上，科技英语也与日常英语有不同之处。由于这些特点，有些学生在公共英语上能获得好的成绩，但在听外国专家作报告时，却几近成为“哑巴”，既不能听懂，又不能顺利地讲出来，更不能提出问题以及与外国专家畅谈自己的科研思想。为了便于学生顺利地从公共英语过渡到能听、说、读以及翻译专业英语，编者尝试性地编辑了这本教材。

本教材按 60～80 学时设定内容及篇幅。所有内容均来自国外植物保护方面的最新教材、期刊和电子文稿。在编注过程中，仅对较长的原文进行了适当压缩和衔接，对原文个别错误的地方进行了订正。在取材时，主要包括植物病理学、昆虫学、农药学、杂草控制、生物防治、啮齿动物、综合防治及论文摘要等方面的知识，各部分

基本遵循由浅入深、由基础知识到新进展的递进方式编排。各单元按题目、课文、单词与词组、注释、思考题和参考文献6个层面进行编排，全书最后按字母顺序列出了词汇表（约1 430词条），词条后用圆括号列出了本词第一次出现的课文序号，便于学习时查找。随着科技飞速发展，新的词汇层出不穷，有些词汇注入了新的含义，本教材仅列出了课文中主要释义和词性，且对词组未标出词性。由于编者水平所限，不当或错误之处恳请广大师生或读者批评指正，以待再版时修订。

第一单元至第五单元和第三十单元由云南农业大学何月秋教授、吴毅歆副教授和周惠萍博士编注，第六单元至第十单元和第二十四单元由甘肃农业大学徐秉良教授、梁巧兰副教授和薛应钰博士编注，第十一单元至第十五单元和第二十九单元由河南农业大学尹新明教授、白素芬副教授和安世恒副教授编注，第十六单元至第十九单元、第二十五单元和第二十七单元由山西农业大学郝赤教授、张仙红教授和阎喜中老师编注，第二十单元至第二十三单元、第二十六单元和第二十八单元由中国农业大学李正西副教授、胡敦孝教授和张力群副教授编注。

在编写过程中，得到编者所在单位云南农业大学、河南农业大学、山西农业大学、中国农业大学和甘肃农业大学的领导的关怀与支持。在最后定稿中，得到云南农业大学王志远和吴兴兴两位同志的帮助。中国农业出版社为本书的出版给予了大力支持，在此一并表示衷心的感谢。

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2008年1月

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目　录

Unit 1 Plant and Disease

Plants make up the majority of the earth's living environment as trees, grass, flowers, and so on. Directly or indirectly, plants also make up all the food on which humans and all animals depend. Even the meat, milk, and eggs that we and other carnivores eat come from animals that depend on plants for their food. Plants are the only higher organisms that can convert the energy of sunlight into stored, usable chemical energy in carbohydrates, proteins, and fats. All animals, including humans, depend on these plant substances for survival.

Plants, whether cultivated or wild, grow and produce well as long as the soil provides them with sufficient nutrients and moisture, sufficient light reaches their leaves, and the temperature remains within a certain "normal" range. Plants, however, also get sick. Sick plants grow and produce poorly, they exhibit various types of symptoms, and often parts of plants or whole plants die. It is not known whether diseased plants feel pain or discomfort.

The agents that cause disease in plants are the same or very similar to those causing disease in humans and animals. They include pathogenic microorganisms, such as viruses, bacteria, fungi, protozoa, and nematodes, and unfavorable environmental conditions, such as lack or excess of nutrients, moisture, and light, and the presence of toxic chemicals in air or soil. Plants also suffer from competition with other, unwanted plants (weeds), and, of course they are often damaged by attacks of insects. Plant damage caused by insects, humans, or other animals is not usually included in the study of plant pathology.

Plant pathology is the study of the organisms and of the environmental factors that cause disease in plants; of the mechanisms by which these factors induce disease in plants; and of the methods of preventing or controlling disease and reducing the damage it causes. Plant pathology is for plants largely what medicine is for humans and veterinary medicine is for animals. Each discipline studies the causes, mechanisms, and control of diseases affecting the organisms with which it deals, i.e., plants, humans, and animals, respectively.

Plant pathology is an integrative science and profession that uses and combines the basic knowledge of botany, mycology, bacteriology, virology, nematology, plant anatomy, plant physiology, genetics, molecular biology and genetic engineering, biochemistry, horticulture, agronomy, tissue culture, soil science, forestry, chemistry, physics, meteorology, and many other branches of science. Plant pathology profits from advances in any one of these sciences, and many advances in other sciences have been made in attempts to solve plant pathological problems.

As a science, plant pathology tries to increase our knowledge about plant diseases. At the same time, plant pathology tries to develop methods, equipment, and materials through which plant disease can be avoided or controlled. Uncontrolled plant disease may result in less food and higher food prices or in food of poor quality. Diseased plant product may sometimes be poisonous and unfit for consumption. Some plant diseases may wipe out entire plant species and many affect the beauty and landscape of our environment. Controlling plant disease results in more food of better quality and a more aesthetically pleasing environment, but consumers must pay for costs of materials, equipment, and labor used to control plant diseases and, sometimes, for other less evident costs such as contamination of the environment.

In the last 100 years, the control of plant diseases and other plant pests has depended increasingly on the extensive use of toxic chemicals (pesticides). Controlling plant diseases often necessitates the application of such toxic chemicals not only on plants and plant produce that we consume, but also into the soil, where many pathogenic microorganisms live and attack the plant roots. Many of these chemicals have been shown to be toxic to nontarget microorganisms and animals and may be toxic to humans. The short-and long-term costs of environmental contamination on human health and welfare caused by our efforts to control plant diseases (and other pests) are difficult to estimate. Much of modern research in plant pathology aims at finding other environmentally friendly means of controlling plant diseases. The most promising approaches include conventional breeding and genetic engineering of disease-resistant plants, application of disease-suppression cultural practices, RNA-and gene-silencing techniques, of plant defense-promoting nontoxic substances, and, to some extent, use of biological agents antagonistic to the microorganisms that cause plant disease.

The challenges for plant pathology are to reduce food losses while improving food quality and, at the same time, safeguarding our environment. As the world population continues to increase while arable land and most other natural resources continue to decrease, and as our environment becomes further congested and stressed, the need for controlling plant disease effectively and safely will become one of the most basic necessities for feeding the hungry billions of our increasingly overpopulated world.

Because it is not known whether plants feel pain or discomfort and because, in any case, plants do not speak or otherwise communicate with us, it is difficult to pinpoint exactly when a plant is diseased. It is accepted that a plant is healthy, or normal, when it can carry out its physiological functions to the best of its genetic potential. The meristematic (cambium) cells of a healthy plant divide and differentiate as needed, and different types of specialized cells absorb water and nutrients from the soil; translocate these to all plant parts; carry on photosynthesis, translocate, metabolize, or store the photosynthetic products; and produce seed or other reproductive organs for survival and multiplication. When the ability of the cells of a plant or plant part to carry out one or more of these essential functions is interfered with by either a pathogenic organism or an adverse environmental factor, the activities of the cells are disrupted, altered, or inhibited, the cells malfunction or die, and the plant becomes diseased. At first, the affliction is localized to one or a few cells and is invisible. Soon, however, the reaction becomes more widespread and affected plant parts develop changes visible to the naked eye. These visible changes are the symptoms of the disease. The visible or otherwise measurable adverse changes in a plant, produced in reaction to infection by an organism or to an unfavorable environmental factor, are a measure of the amount of disease in the plant. Disease in plants, then, can be defined as the series of invisible and visible responses of plant cells and tissues to a pathogenic organism or environmental factors that result in adverse changes in the form, function, or integrity of the plant and may lead to partial impairment or death of plant parts or of the entire plant.

The kinds of cells and tissues that become affected determine the type of physiological function that will be disrupted first. For example, infection of roots may cause roots to rot and make them unable to absorb water and nutrients from the soil; infection of xylem vessels, as happens in vascular wilts and in some cankers, interferes with the translocation of water and minerals to the crown of the plant; infection of the foliage, as happens in leaf spots, blights, rusts, mildews, mosaics, and so on, interferes with photosynthesis; infection of phloem cells in the veins of leaves and in the bark of stems and shoots, as happens in cankers and in diseases caused by viruses, mollicutes, and protozoa, interferes with the downward translocation of photosynthetic products; and infection of flowers and fruits interferes with reproduction. Although infected cells in most diseases are weakened or die, in some diseases, e. g. , in crown gall, infected cells are induced to divide much faster (hyperplasia) or to enlarge a great deal more (hypertrophy) than normal cells and to produce abnormal amorphous overgrowths (tumors) or abnormal organs.

Pathogenic microorganisms, i. e. , the transmissible biotic agents that can cause disease and are generally referred to as pathogens, usually cause disease in plants by disturbing the metabolism of plant cells through enzymes, toxins, growth regulators, and other substances they secrete and by absorbing foodstuffs from the host cells for their own use. Some pathogens may also cause disease by growing and multiplying in the xylem or phloem vessels of plants, thereby blocking the upward transportation of water or the downward movement of sugars, respectively, through these tissues. Environmental factors cause disease in plants when abiotic factors, such as temperature, moisture, mineral nutrients, and pollutants, occur at levels above or below a certain range tolerated by the plants.

◈ 单词与词组

carnivore *n.* 食肉动物

carbohydrate *n.* 碳水化合物

discipline *n.* 学科

nematology *n.* 线虫学

anatomy *n.* 解剖学

horticulture *n.* 园艺学

meteorology *n.* 气象学
aesthetically *adv.* 美学地，审美地
meristematic *adj.* 分生组织的
cambium *n.* 形成层，新生组织
photosynthesis *n.* 光合作用
malfunction *n.* 故障，异常
affliction *n.* 痛苦，苦恼
phloem *n.* 韧皮部
mollicute *n.* 柔膜体纲(植原体)
protozoa *n.* 原生动物
hyperplasia *n.* 增生
hypertrophy *n.* 肥大
amorphous *adj.* 无定形的
overgrowth *n.* 繁茂，生长过度
foodstuff *n.* 食物，粮食
xylem *n.* 木质部

◈ 注释

1. Even the meat, milk, and eggs that we and other carnivores eat come from animals that themselves depend on plants for their food. 即使我们和其他食肉动物吃的肉、牛奶和蛋也都来自动物，而那些动物本身就是以植物为食物的。
2. mollicute，柔膜体纲，或称为软皮体纲。属薄壁菌门原核细胞型微生物。共有 80 多个种。其中有能在人工培养基上生长的人与动物的支原体，有不能在人工培养基上生长的植原体。本文是指植原体。

◈ 思考题

1. What are the causes pathogenic to plants?
2. What is plant pathology?
3. Why does the author say "Plant pathology is an integrative science and profession"?
4. According to the author, plant pathology is facing challenges. What are the challenges?
5. Why does the author consider that the kinds of cells and tissues become affected determine the type of physiological function that will be disrupted first?

◈ 参考文献

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Unit 2 Plant Disease Management

The goal of plant disease management is to reduce the economic and aesthetic damage caused by plant diseases. Traditionally, this has been called plant disease control, but current social and environmental values deem "control" as being absolute and the term too rigid. More multifaceted approaches to disease management, and integrated disease management, have resulted from this shift in attitude, however. Single, often severe, measures, such as pesticide applications, soil fumigation or burning are no longer in common use. Further, disease management procedures are frequently determined by disease forecasting or disease modeling rather than on either a calendar or prescription basis. Disease management might be viewed as proactive whereas disease control is reactive, although it is often difficult to distinguish between the two concepts, especially in the application of specific measures.

The many strategies, tactics and techniques used in disease management can be grouped under one or more very broad principles of action. Differences between these principles often are not clear. The simplest system consists of two principles, prevention and therapy.

The first principle (prevention) includes disease management tactics applied before infection (i. e.., the plant is protected from disease), the second principle (therapy or curative action) functions with any measure applied after the plant is infected (i. e. , the plant is treated for the disease). An example of the first principle is enforcement of quarantines to prevent introduction of a disease agent (pathogen) into a region where it does not occur.

The second principle is illustrated by heat or chemical treatment of vegetative material such as bulbs, corms, and woody cuttings to eliminate fungi, bacteria, nematodes or viruses that are established within the plant material. Chemotherapy is the application of chemicals to an infected or diseased plant that stops (i. e. , eradicates) the infection. Although many attempts have been made to utilize chemotherapy, few have been successful. In a few diseases of ornamental or other high value trees, chemotherapy has served as a holding action that must be repeated at intervals of one to several years. For example, antibiotics have been infused into plants to reduce severity of phytoplasma diseases of palms (lethal yellowing) and pears (pear decline) and fungicides have been injected into elms to reduce severity of Dutch elm disease (caused by *Ophiostoma ulmi*) but in all cases the chemotherapeutant must be reapplied periodically. There also are some "systemic" fungicides such as the sterol biosynthesis inhibiting (SBI) and demethylation inhibiting (DMI) fungicides that diffuse into the plant tissues to some extent and eliminate recently established infections.

Four general disease control principles, however, exclusion, eradication, protection and resistance are accepted commonly today.

Exclusion

This principle is defined as any measure that prevents the introduction of a disease-causing agent (pathogen) into a region, farm, or planting. The basic strategy assumes that most pathogens can travel only short distances without the aid of some other agent such as humans or other vector, and that natural barriers like oceans, deserts, and mountains create obstacles to their natural spread. In many cases pathogens are moved with their host plants or even on nonhost material such as soil, packing material or shipping containers. Unfortunately, exclusion measures usually only delay the entry of a pathogen, although exclusion may provide time to plan how to manage the pathogen when it ultimately arrives. Karnal bunt (caused by *Tilletia indica*) of wheat is an example of a pathogen originally from India that was anticipated. Measures were established to prevent its introduction, but it finally found its way into the United States. Soybean rust (caused by *Phakopsora pachyrhizi*) has been found recently in the southeastern U. S. and precautions have been undertaken to prevent further spread. Due to its destructiveness, South American leaf blight (SALB) (caused by *Microcyclus ulei*) is a feared disease in the major rubber producing region of Indonesia, and contingency plans have been proposed to chemically defoliate rubber trees by aerial application of herbicides if the pathogen is detected. It is hoped that this would prevent establishment of the pathogen in the region.

An important and practical strategy for excluding pathogens is to produce pathogen-free seed or planting stock through certification programs for seeds and vegetatively propagated plant materials such as potatoes, grapes, tree fruits, etc. These programs utilize technologies that include isolation of production areas, field inspections, and removal of suspect plants to produce and maintain pathogen-free stocks. Planting stock that is freed of pathogens can be increased by tissue culture and micropropagation techniques as well as be maintained in protective enclosures such as screenhouses to exclude pathogens and their vectors. Exclusion may be accomplished by something as simple as cleaning farming equipment to remove contaminated debris and soil that can harbor pathogens such as *Verticillium*, nematodes or other soilborne organisms and prevent their introduction into non-infested fields.

Eradication

This principle aims at eliminating a pathogen after it is introduced into an area but before it has become well established or widely spread. It can be applied to individual plants, seed lots, fields or regions but generally is not effective over large geographic areas. Two large attempts at pathogen eradication in the United States were the golden nematode (*Globodera rostochiensis*) program on Long Island, New York and the citrus canker (caused by *Xanthomonas axonopodis* pv. *citri*) program in Florida. However, neither of these attempts was a lasting success.

Eradication of the golden nematode involved removing infested soil, fumigating soil in infested fields and eventually abandoning infested potato fields for housing developments and other uses. Citrus canker eradication involved widespread removal and burning of diseased trees and, in some cases, destruction of entire citrus groves and nurseries. The disease appeared to be contained and the pathogen eradicated, but the disease has reappeared and new attempts at eradication are ongoing.

Eradication can also be on a more modest scale such as the removal of apple or pear branches infected by the fire blight bacterium (*Erwinia amylovora*). Eradication may also be accomplished by destroying weeds that are reservoirs of various pathogens or their insect vectors.

Soil fumigation has been a widely used eradication strategy. This technology involves introducing gas-forming chemicals such as carbon disulfide, methyl bromide, or chloropicrin into soil to kill target pathogens. However, undesirable side effects such as killing beneficial organisms, contamination of groundwater, and toxicity of these chemicals have resulted in less reliance on this approach for disease management.

Crop rotation is a frequently used strategy to reduce the quantity of pathogens, usually soil-borne organisms, in a cropping area. Take-all of wheat (caused by *Gaeumannomyces graminis*) and soybean cyst nematode (*Heterodera glycines*) are two examples of soil-borne diseases that are easily managed by short rotations of 1 and 2 years, respectively, out of susceptible crops, which may include susceptible weed hosts such as grasses in the case of take-all.

Burning is an effective means of eradicating pathogens and is often required by law to dispose of diseased elm trees affected by Dutch elm disease (DED), citrus trees infected by citrus canker or of bean fields infected by halo blight bacteria (*Pseudomonas syringae* pv. *phaseolicola*).

Protection

This principle depends on establishing a barrier between the pathogen and the host plant or the susceptible part of the host plant. It is usually thought of as a chemical barrier, e.g., a fungicide, bactericide or nematocide, but it can also be a physical, spatial, or temporal barrier. The specific strategies employed assume that pathogens are present and that infection will occur without the intervention of protective measures. For example, bananas are covered with plastic sleeves as soon as the fruit are set to protect the fruit from various pests including fruit decay fungi.

Protection often involves some cultural practice that modifies the environment, such as tillage, drainage, irrigation, or altering soil pH. It may also involve changing date or depth of seeding, plant spacing, pruning and thinning, or other practices that allow plants to escape infection or reduce severity of disease. Raising planting beds to assure good soil water drainage is an example of cultural management of plant diseases such as root and stem rots. Many cultural practices can be modified to manage the occurrence,