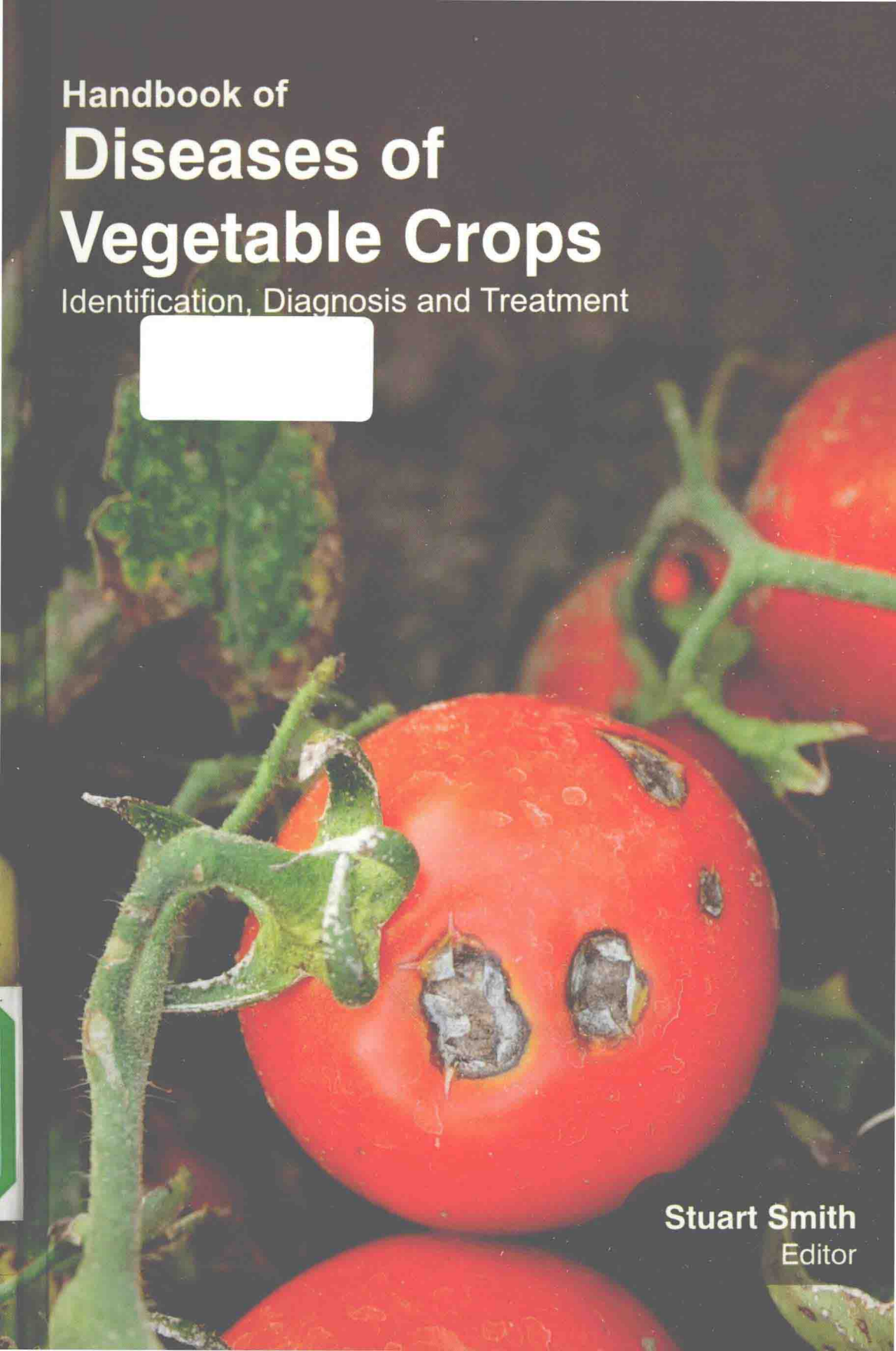
Handbook of

Diseases of Vegetable Crops

Identification, Diagnosis and Treatment



Stuart Smith
Editor

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Plants are vulnerable to many diseases. These diseases are mostly caused by fungi and viruses. There are also a few bacterial infections that attack plants and produce similar symptoms to those of fungi. There is a long list of ways plant diseases can sneak into a garden and attack the plants. This book deals with lists of some very common plant disease, what they infect, symptoms and how to prevent and control them. It presents the technology of disease management according to epidemiological principles. It combines theoretical and practical elements into the solid background that practitioners and researchers need in plant disease management. The book will be an invaluable source for all professionals, researchers and students in this subject and for anyone working in the related areas for acquiring an up-to-date overviews.

About the Editor

Dr Stuart Smith, Ph.D. in Plant Biology from the University of Ballarat in 1996 and Master of Science in Plant Biology from the University of Perth in 1990 has been an eminent scholar in the field of plant science. He has various arcicles and books on his name ad is contineously thriving for development in his area of expertise.

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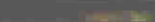

Handbook of Diseases of Vegetable Crops

Identification, Diagnosis and Treatment

VOLUME 1

Editor

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Handbook of Diseases of Vegetable Crops: Identification, Diagnosis and Treatment

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Identification, Diagnosis and Treatment

Preface

Plants are vulnerable to many diseases. These diseases are mostly caused by fungi and viruses. There are also a few bacterial infections that attack plants and produce similar symptoms to those of fungi. Their is a long list of ways plant diseases can sneak into a garden and attack the plants. They can already be present in the seeds you sow. They could be in the soil around the roots of a plant, or carried in the soil on the soles of your shoes. They may also come in on new plants or plant material from the nursery or garden store where you purchased them. They can even arrive in the garden on a wind. Here is a list of some very common plant disease, what they infect, symptoms and how to prevent and control them. Mildew affects peas, onions, lettuce, spinach and cabbage. The powdery and downy mildew produce a white or gray mold, it is often found in round patches. Downey mildew appears on the undersides of leaves in cool, damp conditions. Powdery mildew forms on the top in dry conditions. To prevent this disease do not overcrowd plants or over water them. Look for mildew resistant varieties. Remove any plant debris promptly. To chemically control them you will use green and yellow sulphur for powdery mildew and for down mildew you will use the chemical mancozeb.

Blight disease affects potatoes and tomatoes. Blight favours warm, wet weather. It progresses rapidly on potatoes. The first signs are dark blotches on the leaves, followed by rapid wilting and yellowing of the foliage and stems. Then the plant will usually collapse in a few days. Blight is less dramatic on tomatoes, but is still serious. The leaves start collapsing and the fruit develop brown rotting patches. A different organism is responsible for early blight, which causes brown spots on the leaves it is much less serious. Warnings are often given when the right combination of humidity and temperature are present. To prevent further damage when you spot the disease on potato foliage remove and burn the top growth. If you harvest the crop right away the tubers may be unaffected. Destroy infected crop remains

by burning them. Planting tomatoes in greenhouse are less likely to be attacked by this disease. There are a few different types of chemicals you can use on this disease they are mancozeb, copper sulphate and copper oxychloride. Botrytis disease affects many different crops, especially lettuce and tomatoes. It produces a fluffy gray mold growth, under this growth the plant tissue rots. This fungus starts on dead tissue but spreads quickly to live parts. It is found quite often in greenhouses. It prefers cool, damp places. To help prevent this disease keep greenhouses well ventilated. Make sure your plants are not overcrowded, water early in the day and do not splash water. When you spot any of this disease clear all the dead and dying plant debris away. Cut out and destroy any affected parts. Wilt disease affects tomato and cabbage family. Fusarium wilt is the most common type. Young plants become pale and stunted, lower leaves yellow and wilt. The symptoms move upward and plants may die. Verticillium wilt causes similar symptoms but without one-sided effects. Wilt diseases are worse in the hot weather. To prevent this disease grow only disease resistant plants. Clear away any infected plant debris and rotate crops. Their are no chemicals to use on this disease.

The book will be an indispensable source for all professionals, researchers and students in this subject and for anyone working in the related areas for acquiring an up-to-date overviews.

—Editor

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VOLUME 2

Chapter 1

Introduction

In culinary terms, a vegetable is an edible plant or its part, intended for cooking or eating raw. In biological terms, "vegetable" designates members of the plant kingdom. The non-biological definition of a vegetable is largely based on culinary and cultural tradition. Apart from vegetables, other main types of plant food are fruits, grains and nuts.

Vegetables are most often consumed as salads or cooked in savory or salty dishes, while culinary fruits are usually sweet and used for desserts, but it is not the universal rule. Therefore, the division is somewhat arbitrary, based on cultural views.

For example, some people consider mushrooms to be vegetables even though they are not biologically plants, while others consider them a separate food category; some cultures group potatoes with cereal products such as noodles or rice, while most English speakers would consider them vegetables.

Some vegetables can be consumed raw, some may be eaten cooked, and some must be cooked to destroy certain natural toxins or microbes in order to be edible, such as eggplant, unripe tomatoes, potatoes, daylily, winter melon, fiddlehead fern, and most kinds of legume/beans (such as common beans).

A number of processed food items available on the market contain vegetable ingredients and can be referred to as "vegetable derived" products. These products may or may not maintain the nutritional integrity of the vegetable used to produce them.

"Vegetable" comes from the Latin *vegetabilis* (animated) and from *vegetare* (enliven), which is derived from *vegetus* (active), in reference to the process of a plant growing.

The word "vegetable" was first recorded in English in the 15th century, and originally applied to any plant. This is still the sense of the adjective "vegetable" in biological context. In 1767, the meaning of the term "vegetable" was specified to mean "plant cultivated for food, edible herb or root." The year 1955 noted the first use of the shortened, slang term "veggie".

As an adjective, the word vegetable is used in scientific and technical contexts with a different and much broader meaning, namely of "related to plants" in general, edible or not — as in *vegetable matter*, *vegetable kingdom*, *vegetable origin*, etc. The meaning of "vegetable" as "plant grown for food" was not established until the 18th century.

Terminology

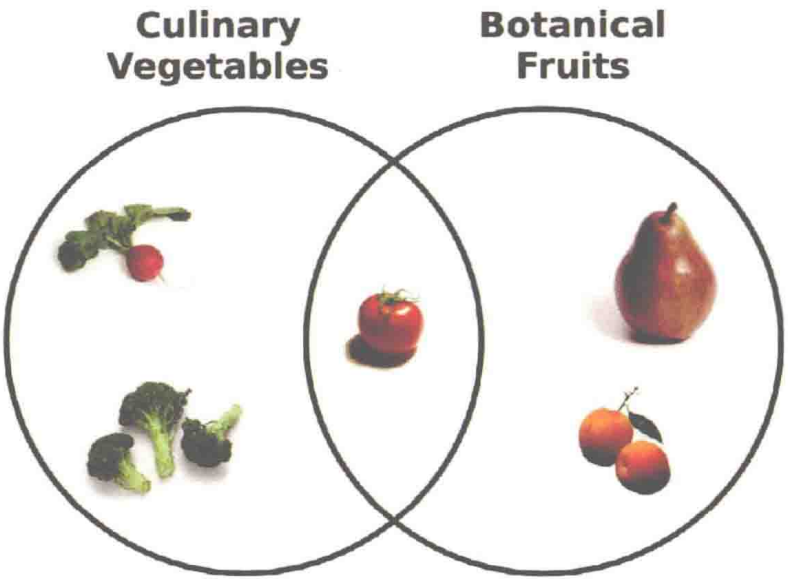

Figure: *A Venn diagram shows the overlap in the terminology of "vegetables" in a culinary sense and "fruits" in the botanical sense*

There are at least four definitions relating to fruits and vegetables:

- Fruit (botany): the ovary of a flowering plant (sometimes including accessory structures),
- Fruit (culinary): any edible part of a plant with a sweet flavour,
- Vegetable (culinary): any edible part of a plant with a savory flavour.
- Vegetable (legal): commodities that are taxed as vegetables in a particular jurisdiction

In everyday, grocery-store, culinary language, the words "fruit" and "vegetable" are mutually exclusive; plant products that are called fruit are hardly ever classified as vegetables, and vice-versa. The word "fruit" has a precise botanical meaning (a part that developed from the ovary of a flowering plant), which is considerably different from its culinary meaning, and includes many poisonous fruits. While peaches, plums, and oranges are "fruit" in both senses, many items commonly called "vegetables" — such as eggplants, bell peppers, and tomatoes — are botanically fruits, while the cereals (grains) are both a fruit and a vegetable, as well as some spices like black pepper and chili peppers. The question of whether the tomato is a fruit or a vegetable found its way into the United States Supreme Court in 1893. The court ruled unanimously in *Nix v. Hedden* that a tomato is correctly identified as, and thus taxed as, a vegetable, for the purposes of the Tariff of 1883 on imported produce. The court did acknowledge, however, that, botanically speaking, a tomato is a fruit.

Languages other than English often have categories that can be identified with the common English meanings of "fruit" and "vegetable", but their precise meaning often depends on local culinary traditions. For example, in Brazil the avocado is traditionally consumed with sugar as a dessert or in milkshakes, and hence it is regarded as a culinary fruit; whereas in other countries (including Mexico and the United States) it is used in salads and dips, and hence considered to be a vegetable.

Examples of Different Parts of Plants Used as Vegetables

The list of food items called "vegetable" is quite long, and includes many different parts of plants:

Flower Bud: broccoli, cauliflower, globe artichokes, capers

Leaves: kale, collard greens, spinach, arugula, beet greens, bok choy, chard, choi sum, turnip greens, endive, lettuce, mustard greens, watercress, garlic chives, gai lan

Leaf Sheaths: leeks

Buds: Brussels sprouts

Stem: Kohlrabi, galangal, and ginger

Stems of Leaves: celery, rhubarb, cardoon, Chinese celery

Stem Shoots: asparagus, bamboo shoots

Tubers: potatoes, Jerusalem artichokes, sweet potatoes, taro, and yams

Figure: *A coriander leaf*

Whole-Plant Sprouts: soybean, mung beans, urad, and alfalfa

Roots: carrots, parsnips, beets, radishes, rutabagas, turnips, and burdocks

Bulbs: onions, shallots, garlic

Fruits in the Botanical Sense, but Used as Vegetables: tomatoes, cucumbers, squash, zucchinis, pumpkins, peppers, eggplant, tomatillos, chayote, okra, breadfruit, avocado, pods, seeds such as corn, green beans and snow peas.

Nutrition

Vegetables are eaten in a variety of ways, as part of main meals and as snacks. The nutritional content of vegetables varies considerably, though generally they contain little protein or fat, and varying proportions of vitamins such as Vitamin A, Vitamin K and Vitamin B6, provitamins, dietary minerals and carbohydrates. Vegetables contain a great variety of other phytochemicals, some of which have been claimed to have antioxidant, antibacterial, antifungal, antiviral and anticarcinogenic properties. Some vegetables also contain fiber, important for gastrointestinal function. Vegetables contain important nutrients necessary for healthy hair and skin as well. A person who refrains from dairy and meat products, and eats only plants (including vegetables) is known as a vegan.

Figure: *South Asian style stir fry ipomoea aquatica in chili and sambal*

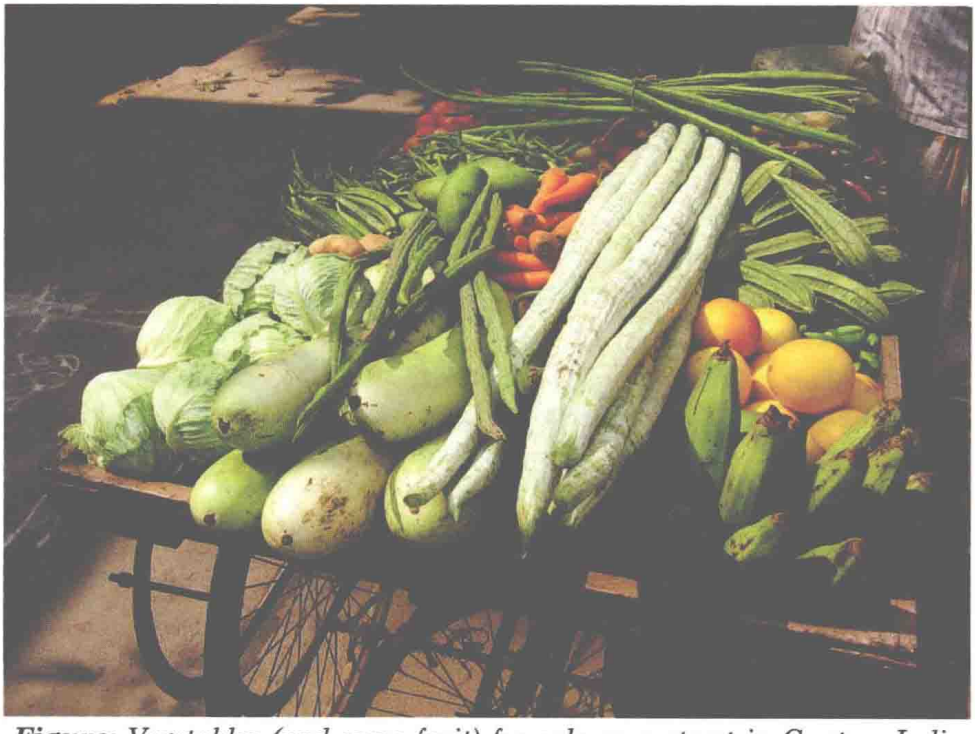

Figure: *Vegetables (and some fruit) for sale on a street in Guntur, India*

However, vegetables often also contain toxins and antinutrients such as á-solanine, á-chaconine, enzyme inhibitors (of cholinesterase, protease, amylase, etc.), cyanide and cyanide precursors, oxalic acid, and more.

Depending on the concentration, such compounds may reduce the edibility, nutritional value, and health benefits of dietary vegetables. Cooking and/or other processing may be necessary to eliminate or reduce them.

Diets containing recommended amounts of fruits and vegetables may help lower the risk of heart diseases and type 2 diabetes. These diets may also protect against some cancers and decrease bone loss. The potassium provided by both fruits and vegetables may help prevent the formation of kidney stones.

Dietary Recommendations

The USDA Dietary Guidelines for Americans recommends consuming 3 to 5 servings of vegetables daily. This recommendation can vary based on age and gender, and is determined based upon standard portion sizes typically consumed, as well as general nutritional content. For most vegetables, one serving is equal to 1/2 cup and can be eaten raw or cooked.

For leafy greens, such as lettuce and spinach, a single serving is typically 1 cup. Serving sizes for vegetable-derived products have not been definitively determined, but usually follow the 1/2 cup standard. Examples of vegetable-derived products subject to this standard are ketchup, pizza sauce, and tomato paste. Currently, there is no specific standard for measuring a vegetable serving in regards to its nutrient content, since different vegetables contain a wide variety of nutrients.

International dietary guidelines are similar to the ones established by the USDA. Japan, for example, recommends the consumption of 5 to 6 servings of vegetables daily. French dietary guidelines follow similar guidelines and set the daily goal at 5 servings.

Colour Pigments

The green colour of leaf vegetables is due to the presence of the green pigment chlorophyll. Chlorophyll is affected by the pH, and it changes to olive green in acid conditions, and to bright green in alkaline conditions. Some of the acids are released in steam during cooking, particularly if cooked without a cover.