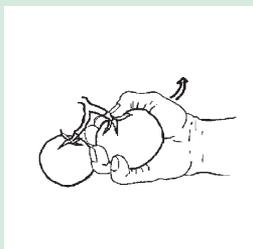


Cultivation of tomato

production, processing and marketing



Agrodok 17

Cultivation of tomato

production, processing and marketing

Shankara Naika
Joep van Lidt de Jeude
Marja de Goffau
Martin Hilmi
Barbara van Dam

This publication is sponsored by PROTA.

© Agromisa Foundation and CTA, Wageningen, 2005.

All rights reserved. No part of this book may be reproduced in any form, by print, photocopy, microfilm or any other means, without written permission from the publisher.

First edition: 1989

Second edition: 1993

Third edition: 2002

Fourth completely revised edition: 2005

Authors: Shankara Naika, Joep van Lidt de Jeude, Marja de Goffau, Martin Hilmi, Barbara van Dam

Editor: Barbara van Dam

Illustrator: Barbera Oranje

Design: Eva Kok

Translation: Sara van Otterloo-Butler

Printed by: Digigrafi, Wageningen, Netherlands

ISBN Agromisa: 90-8573-039-2

ISBN CTA: 92-9081-299-0

Foreword

Tomato is one of the most widely cultivated crops in the world. It is an important source of vitamins and an important cash crop for small-holders and medium-scale commercial farmers.

This Agrodok focuses on good practices for growing a healthy tomato crop and obtaining a reasonably steady yield. It provides practical information on small-scale cultivation, harvesting, storing, processing and marketing of tomatoes. Seed selection and conservation, integrated pest management methods and record keeping are also covered. We hope this information will be helpful to vegetable growers, whether beginners or more experienced farmers, extension workers and agricultural teachers.

In this revised edition, the sections on pepper and paprika growing in previous editions have been omitted to make room for information on all the above-mentioned aspects of tomato cultivation.

Agromisa entered a cooperation agreement with PROTA for the development of this publication. For more information on PROTA see the section at the back of this Agrodok.

We wish to express our thanks to Jan Siemonsma and Chris Bosch of PROTA, and to Remi Nono-Womdim, Gerard Grubben, Rene Geelhoed, Bianca van Haperen and Guus van den Berg for their comments on the manuscript.

We invite you as a reader to send your comments and suggestions on how to improve or extend the contents of this Agrodok.

The authors
Wageningen, September 2005

Contents

1	Introduction	6
1.1	A brief description of tomato	6
2	Requirements for successful cultivation	10
2.1	Climate and soil	10
2.2	Choice of varieties	11
3	Preparation and planting	13
3.1	Land preparation	13
3.2	Seedlings	13
3.3	Transplanting	14
4	Crop husbandry	16
4.1	Manures and fertilisers	16
4.2	Watering	18
4.3	Pruning	20
4.4	Support systems	22
4.5	Weed control	24
4.6	Crop rotation	26
4.7	Protected cultivation	28
4.8	Organic farming	33
4.9	Sanitation practices	36
5	Pests and diseases	37
5.1	Nematodes	37
5.2	Insects	39
5.3	Diseases	44
5.4	Other causes of crop damage	54
5.5	Control of pests and diseases	55
6	Harvest and seed production	60
6.1	Harvest labour planning	61
6.2	When to harvest	62

6.3	Seed selection and cultivation	63
6.4	Hybrid seed production	63
6.5	Seed quality	64
7	Post harvest handling	65
7.1	Handling	65
7.2	Storage	67
7.3	Processing	69
8	Marketing	78
8.1	What is a market?	78
8.2	Financing	80
	About PROTA	87
	Further reading	88
	Useful addresses	90
	Glossary	91

1 Introduction

1.1 A brief description of tomato

Tomato (*Lycopersicon esculentum* Mill.) is one of the most important vegetables worldwide. World tomato production in 2001 was about 105 million tons of fresh fruit from an estimated 3.9 million ha. As it is a relatively short duration crop and gives a high yield, it is economically attractive and the area under cultivation is increasing daily. Tomato belongs to the *Solanaceae* family. This family also includes other well-known species, such as potato, tobacco, peppers and eggplant (aubergine).

Tomato has its origin in the South American Andes. The cultivated tomato was brought to Europe by the Spanish conquistadors in the sixteenth century and later introduced from Europe to southern and eastern Asia, Africa and the Middle East. More recently, wild tomato has been distributed into other parts of South America and Mexico.

Common names for the tomato are: tomate (Spain, France), tomat (Indonesia), faan ke'e (China), tomati (West Africa), tomatl (Nahuatl), jitomate (Mexico), pomodoro (Italy), nyanya (Swahili).

Tomatoes contribute to a healthy, well-balanced diet. They are rich in minerals, vitamins, essential amino acids, sugars and dietary fibres. Tomato contains much vitamin B and C, iron and phosphorus. Tomato fruits are consumed fresh in salads or cooked in sauces, soup and meat or fish dishes. They can be processed into purées, juices and ketchup. Canned and dried tomatoes are economically important processed products.

Yellow tomatoes have higher vitamin A content than red tomatoes, but red tomatoes contain lycopene, an anti-oxidant that may contribute to protection against carcinogenic substances.
--

Tomato (see Figure 1) is an annual plant, which can reach a height of over two metres. In South America, however, the same plants can be harvested for several years in succession. The first harvest is possible 45-55 days after flowering, or 90-120 days after sowing. The shape of the fruit differs per cultivar. The colour ranges from yellow to red.



Tied up along the stem

Different shapes of the fruit

- A: quick cultivar with flat, ribbed fruit*
- B: late cultivar with large fruit*
- C: Anglo-Dutch cultivar*
- D: cultivar with oblong fruit*
- E: various cultivars of cherry tomato*

Figure 1: Tomato

Three different types of tomato plants can be distinguished:

- tall or indeterminate type
- semi-bush or semi-indeterminate type
- bush or determinate type

The tall and bush types are entirely different kinds of crops.

The tall varieties are the best choice for a long harvest period. They keep growing after flowering. This feature is called indeterminate. However, under tropical conditions, diseases and insect attacks will stop growth. The plants generally have more foliage. This will keep the temperature lower within the crop and the fruits grow in the shade of the leaves. Because they are covered, the sun does not damage the fruits and they ripen more slowly. Slower ripening and a high leaf/fruit ratio improve the taste of the fruits and in particular the sweetness. The tall types have to be staked, caged or trellised (see Chapter 4).

Short types usually support themselves and need no staking. Under severe weather conditions such as typhoons, however, staking may be advisable. Determinate types stop growing after flowering. They require less labour, so they are popular for commercial cultivation. They have a relatively concentrated fruit set which lasts only two or three weeks and the fruits ripen much faster than those from indeterminate types.

Advantages of tomato:

- relatively short duration vegetable crop
- short or long production period
- can be grown as an uncovered field crop and in protected cultivation
- fits easily into different cropping systems
- has high economic value
- has high micronutrient content
- fruits can be processed, dried and canned

Botanical description of tomato plant

- Root:** Vigorous tap root system that grows to a depth of 50 cm or more. The main root produces dense lateral and adventitious roots.
- Stem:** Growth habit ranges between erect and prostrate. It grows to a height of 2-4 m. The stem is solid, coarse, hairy and glandular.
- Leaf:** Spirally arranged, 15-50 cm long and 10-30 cm wide. Leaflets are ovate to oblong, covered with glandular hairs. Small pinnates appear between larger leaflets. Inflorescence is clustered and produces 6-12 flowers. Petiole is 3-6 cm.
- Flower:** Bisexual, regular and 1.5-2 cm in diameter. They grow opposite or between leaves. Calyx tube is short and hairy, sepals are persistent. Usually 6 petals up to 1 cm in length, yellow and reflexed when mature. 6 stamens, anthers are bright yellow in colour surrounding the style with an elongated sterile tip. Ovary is superior and with 2-9 compartments. Mostly self- but partly also cross-pollinated. Bees and bumblebees are the most important pollinators.
- Fruit:** Fleshy berry, globular to oblate in shape and 2-15 cm in diameter. The immature fruit is green and hairy. Ripe fruits range from yellow, orange to red. It is usually round, smooth or furrowed.
- Seeds:** Numerous, kidney or pear shaped. They are hairy, light brown 3-5 mm long and 2-4 mm wide. The embryo is coiled up in the endosperm. Approximate weight of 1000 seeds is 2.5 – 3.5 g.