

# Biological Constraints in Tomato Production in the Western Highlands of Cameroon

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## Summary

*Tomato (Lycopersicon esculentum) production is handicapped by damage due to pests and pathogens. Farmers' fields in the western highlands of Cameroon were surveyed during 1993 to 1996 to identify biological constraints in production. Diseases and insect pests are the most important biological limitations in tomato production. Late blight caused by Phytophthora infestans and early blight caused by Alternaria solani are the most severe diseases, while the melon fruitfly (Dacus cucurbitae) is the most prevalent insect pest. Yield losses due to pest damage are high and reach 100% when the crop is not treated in the wet season. Pest-resistant varieties are not available to farmers. Consequently, growers practise intensive pesticidal spray programmes to limit losses caused by pests and diseases. Results indicate the necessity for the adoption of integrated pest management strategies in tomato production in Cameroon.*

## Résumé

*La production de la tomate (Lycopersicon esculentum) est souvent entravée par les dommages causés par des ravageurs et des pathogènes. Des enquêtes ont été menées auprès de planteurs dans les hautes terres de l'ouest-Cameroun de 1993 à 1996 pour identifier les contraintes biologiques liées à la production de la tomate. Les maladies et les insectes constituent les plus grandes limitations de la production de cette culture. Le mildiou causé par Phytophthora infestans et l'alternariose due à Alternaria solani sont les maladies les plus sévères, tandis que la mouche de fruit (Dacus cucurbitae) est le ravageur le plus prévalent. Les pertes dues aux maladies et ravageurs sont très élevées, atteignant 100% quand les plantes ne sont pas traitées en saison pluvieuse. Les variétés résistantes aux ravageurs ne sont pas disponibles pour les planteurs. Par conséquent, ceux-ci pratiquent des traitements pesticides intenses afin de limiter les pertes dues aux insectes et aux maladies. Les résultats indiquent la nécessité d'adoption de stratégies de la lutte intégrée dans la production de la tomate au Cameroun.*

## Introduction

Tomato (*Lycopersicon esculentum* Mill.) is the most widely cultivated field vegetable crop in Cameroon. Intensive commercial production is practised in the western highland areas, where the crop is an important source of revenue for both producers and exporters. The fruit may be eaten fresh or cooked, and large quantities are used to produce soup, juice, sauce, ketchup or paste (17).

Tomato yields in Cameroon are estimated at 15,882 kg/ha for 1992 (2). This is much lower than the mean world (24,328 kg/ha) or African (20,400 kg/ha) figures for the same year (2). Such low yields are apparently due to high losses caused by pests and pathogen damage (3,6,9,13,16). The identification of the major limitations to increased production is necessary to develop strategies for crop improvement.

The aim of this paper was to identify biological constraints in tomato production in the western highlands of Cameroon and to discuss current pest management methods used by tomato growers.

## Methodology

### 1. Survey Area

A survey of biological constraints in tomato production was conducted in the western highlands of the west and northwest provinces of Cameroon. The survey was concentrated in the Dschang (1400 m) and Foubot (1100 m) production areas. The main soil type is ferrallitic in Dschang or volcanic in Foubot. The climate of the whole region is characterized by a long wet season, from mid-March to October, followed by a short dry season, from November to mid-March. Annual rainfall ranges from 1500 to 2000 mm. Mean annual temperature and relative humidity range 16 to 27°C and 60 to 97%, respectively. The region is densely populated, with more than 250 inhabitants/km<sup>2</sup>, and agricultural pressure on the land is very high. Consequently, the amount of land used for vegetable growing is often less than 1 ha per grower.

### 2. Methods

The survey was carried out between October 1993 to September 1996. A total of 103 farmers were involved:

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55 in Dschang and 48 in Foumbot. In each site, data were obtained through a formal questionnaire, informal discussion with growers and direct field observation. Farmers were first asked to state their major production constraint. Parameters studied in the questionnaire included cropping techniques (variety cultivated, crop rotation, season, fertilization, etc), field pests and diseases, postharvest problems, other constraints and methods of management adopted.

In each site, tomato crops were observed in both dry and wet seasons. After each random field survey, diseased plant materials were collected and stored in plastic bags. Pests and diseases were identified in the plant pathology laboratory of the University of Dschang (3,7,9,11). Results of the survey are expressed in percentage of responses obtained.

## Results

### Major Production Constraints

The most important constraint in tomato production, as perceived by farmers in Dschang, is damage due to diseases (48%), followed by the uncertainty of the market (18%). In Foumbot area, diseases (31%) and insect pests (26%) are the greatest concern for growers. Farmers in both locations complained of the high cost of pesticides (Figure 1). Other constraints recorded in both locations are lack of irrigation facilities, lack of pest-resistant planting materials, bad roads, damping-off of seedlings in nurseries, competition with a large number of small producers in the dry season, and limited storage life of fruits.

#### Field diseases

The most prevalent diseases encountered in nursery are late blight caused by *Phytophthora infestans* (Mont.) de Bary, early blight caused by *Alternaria solani* Sor., and damping-off and seedling blights caused by *Pythium* spp., *Rhizoctonia solani* Kuhn and *Verticillium albo-atrum* Rke & Berth.

In the wet season, most farmers (59%) reported severe attacks of late blight in the field, while, in the dry season, 39% of them indicated that early blight is the most severe disease (Table 1). Both diseases cause

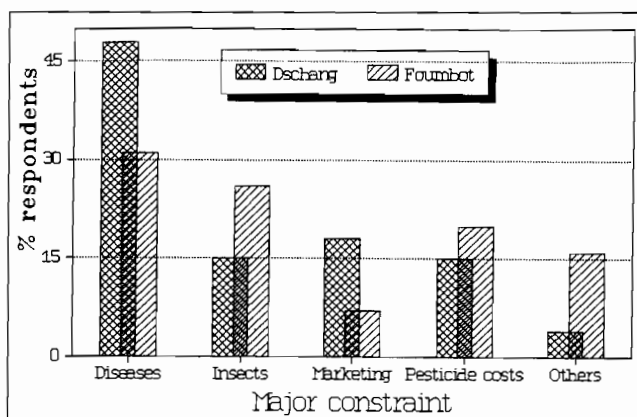


Figure 1. Major constraints in tomato production as perceived by growers in two locations in the western highlands of Cameroon.

**Table 1**  
Major diseases of tomato as perceived by farmers during two seasons in the western highlands of Cameroon

Disease	Pathogen	% respondents	
		Wet season	Dry season
Late blight	<i>Phytophthora infestans</i>	59	13
Early blight	<i>Alternaria solani</i>	9	39
Bacterial wilt	<i>Pseudomonas solanacearum</i>	7	18
Bacterial canker	<i>Clavibacter michiganensis</i> subsp. <i>michiganensis</i>	5	13
Root knot	<i>Meloidogyne</i> sp.	4	2
Viruses	-	4	7
Damping-off	<i>Rhizoctonia solani</i>	7	5
Others	<i>Pythium</i> sp.	5	3

severe losses of fruits in the field and during storage. Other diseases observed in the field are bacterial wilt (*Pseudomonas solanacearum* (Smith) Smith), bacterial canker (*Clavibacter michiganensis* subsp. *michiganensis* (Smith) David *et al.*), root knot nematodes (*Meloidogyne* spp.) and various viral infections (Table 1). Viruses were not identified because of lack of appropriate kits. Characteristic virus symptoms found were veinal mottling, mosaic, leaf curl and fern leaf.

Diseases that were also noted to a lesser extent were stem blight (*Sclerotium rolfsii* Sacc., *Pythium* spp., *R. solani*), Fusarium wilt and root rot (*Fusarium oxysporum* f. sp. *lycopersici* (Sacc.) Snyd. & Hans.), bacterial stem and soft rot (*Erwinia carotovora* subsp. *carotovora* (Jones) Bergey *et al.*), leaf mould (*Fulvia fulva* (Cke) Cif.), bacterial spot (*Xanthomonas campestris* pv. *vesicatoria* (Doidge) Dye).

#### Field Pests

The most prevalent insect pests observed by farmers are those that cause direct damage to fruits. These are the melon fruitfly (*Dacus cucurbitae* Coq) (72%) and the fruit worm (*Helicoverpa armigera* Hub.) (49%). About 40% and 26% of the farmers indicated the sweet potato whitefly (*Bemisia tabaci* Genn.) and aphids (*Macrosiphum* sp., *Myzus persicae* Sulzer), respectively, as important pests of the foliage (Table 2). Other pests (14%) of tomato are the leaf miner (*Liriomyza* sp.), spider mite (*Tetranychus urticae* Koch), birds and rodents.

#### Postharvest Disorders

Farmers do not usually store their produce for more than one week because of disease problems. The most prevalent postharvest diseases are late blight (predominantly in the wet season) and early blight (mostly in the dry season). Other diseases, identified on fruits, are buckeye rot (*Phytophthora nicotianae* B. de Haan.

**Table 2**  
Major pests of tomato production as perceived by growers in Cameroon

Pest	% respondents
Melon fruit fly	72
Fruit worm	49
Sweet potato whitefly	40
Aphids	26
Others	14

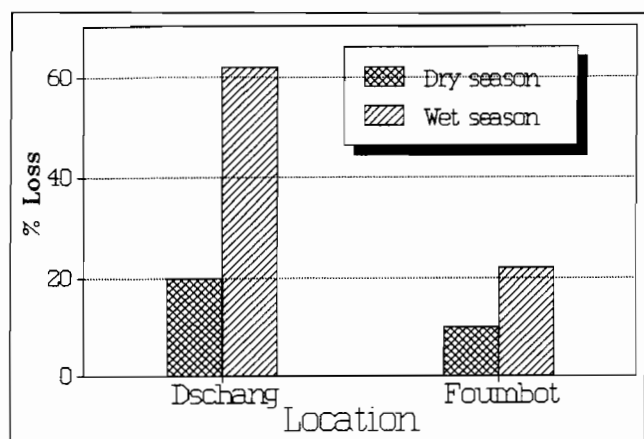


Figure 2. Field losses reported by tomato farmers during wet and dry seasons in two locations in the western highlands of Cameroon.

var. *parasitica* (Dast.) Waterh.), black mould rot (*Alternaria alternata* (Fr.) Keissl.), soft rot (*E. carotovora* subsp. *carotovora*), Fusarium rot (*F. oxysporum* f. sp. *lycopersici*), grey mould rot (*Botrytis cinerea* (Fr.) Pers.), and sour rot (*Geotrichum candidum* Link). Bacterial soft rot and Fusarium rot infections are often associated with damage caused by fruitfly and fruit worm or mechanical injuries on fruits.

Farmers recorded higher losses in the wet season than in the dry season. Growers in Dschang reported about 60% losses in the wet season and 20% in the dry season, while those in Foumbot indicated lower figures for both seasons (Figure 2). Yield losses usually reached 100% when tomatoes were not treated in the wet season. Many farmers in Dschang reported a total loss of their crops because of inadequate control of late blight in the wet season.

### Cultural Techniques

The most cultivated tomato variety was Roma VF (79%), followed by Rio Grande (63%) and Heinz (31%). Farmers in both locations prefer small-size varieties, such as Roma VF or Rio Grande, because they are very well accepted by consumers. Other varieties cultivated to a lesser extent were Marglobe, Marmande, Market Wonder, St Peter, Rossol, Bandera, Caraibe or Nemador. None of these varieties appeared to be resistant to early or late blight.

Few farmers (12-15%) indicated that they produced tomato solely in the dry season. However, all commercial growers, planted the crop in both seasons, while none grew it exclusively in the wet season. Tomato was grown entirely as a pure crop on ridges or beds in open fields. Most farmers (85-88%) practised crop rotation (Table 3). Tomato was often rotated with maize, cabbage, bean or other non solanaceous vegetables. Some farmers reported that they have rotated tomato with tomato or potato and have had severe late blight infections. Most growers (95-100%) used stakes or trellises to support their crop in the field. Pruning of diseased leaves was practised by few (17%) of them. However, the pruned leaves were always abandoned on the ground below the plants.

Fertilizers were used intensively in both locations. Most

farmers felt that fertilizers were more important in field crops than in the seedbed. In addition to mineral fertilizers, most farmers applied organic fertilizers, such as chicken droppings, cow dung or kitchen refuse. The most used mineral fertilizer was 20:10:10 NPK, followed by 12:6:20. Quantities reported were variable, but most farmers applied a tablespoonful of each fertilizer per stem.

### Phytosanitary treatments

General pest management methods are outlined in Table 3. All growers surveyed indicated that they use pesticides in their farms. Few (< 5%) farmers treated the soil against nematodes or soil-borne fungi. All farmers treated their farms against late blight and insect pests. About 39% of the farmers indicated that they controlled only late blight, 61% controlled both early and late blights, while none controlled only early blight.

Table 3  
Pest management tactics used by tomato growers in two locations in the western highlands of Cameroon

Management tactic	% respondents	
	Dschang	Foumbot
Chemical treatment	100	100
Host plant resistance	0	0
Cultural techniques	-	-
Choice of season	15	12
Crop rotation	85	88
Staking/trellises	100	95
Residue management	9	12
Others	5	6

The most used fungicide was maneb (89%), followed by Ridomil Plus (12% metalaxyl + 60% cuprous oxide) (42%) and Dacobre (25% chlorothalonil + 25% copper oxychloride) (18%). The most used insecticide was deltamethrin (52%), followed by alphacypermethrin (48%), methyl parathion (32%) and cypermethrin (24%) (Table 4). Other insecticides were chlorpyrifos, lindane, endosulfan, dimethoate, and cyhalothrin. The most used nematicide was carbofuran. About 31% of the farmers indicated that applications of Ridomil Plus induce flower abscission. This situation could be attributable to the high rates of application observed in the field. Fungicidal spray rates were usually 3 to 5 times higher than recommended rates. Farmers spray the crop until the chemical mixture is visible on the foliage.

Most farmers (57-58%) in both locations applied between 10 to 20 pesticidal sprays during the dry season. During the wet season, most (57%) growers in Dschang

Table 4  
Main pesticides used in tomato production in the western highlands of Cameroon

Pesticide	% respondents
<b>Fungicide</b>	
Maneb	89
Ridomil Plus	42
Dacobre	18
Others	14
<b>Insecticide</b>	
Deltamethrin	52
Alpha-cypermethrin	48
Methyl parathion	32
Cypermethrin	24
Others	16

**Table 5**  
**Number of pesticidal sprays applied in each season to control tomato pests in two locations in the western highland of Cameroon**

Number	Dschang		Foumbot	
	Wet season	Dry season	Wet season	Dry season
0	0 <sup>2</sup>	0	0	8
< 10	0	29	0	17
10 to 20	7	57	9	58
20 to 30	36	0	72	17
30 to 40	57	0	18	0
> 40	0	0	0	0

<sup>2</sup> Percentage of respondents.

applied 30-40 pesticidal treatments, while 72% of Foumbot farmers sprayed the crop 20-30 times (Table 5).

Tomato farmers in both locations rarely used appropriate protective clothing when mixing or applying pesticides. About 4% wore gloves, 6% hats, 21% boots, and 28% overalls. None of them indicated having used goggles, face mask or respirator. Few farmers complained of having headache or stomach problems after each heavy pesticidal treatment.

## Discussion

This study reveals that about twenty diseases infect tomatoes in the western highlands of Cameroon. Although farmers in Dschang apply more pesticidal applications than those in Foumbot, losses recorded in their fields were higher than those observed in Foumbot. The Foumbot production area appeared to be more suitable for tomato production because of lower losses recorded by farmers (3,6). Foumbot, being on a lower altitude than Dschang, is warmer than the latter. Late blight is particularly severe in a cool weather (7,9). The high yield losses were attributable primarily to damage by pathogens. Late blight, the most important disease of tomato in Cameroon (3,6), has been described as the world's single, most important crop disease (1). High incidence of aphids and whitefly, two important

vectors of viruses, indicate that viral infections might be a problem in tomato fields. Viral infections are often overlooked by farmers because of lack of appropriate methods of virus identification and control. Most common virus symptoms identified were the leaf curl and yellow mosaic diseases, both vectored by whiteflies, and veinal mottling transmitted by aphids (7).

The general problems encountered on tomato production in Cameroon are similar to those reported in North Africa (10,12). Poor pest management practices cause severe field losses. Pruned leaves left below the plants could serve as sources of inoculum. Moreover, pruning increases the incidence of bacterial canker and other systemic diseases (7).

Pest-resistant varieties are not available to farmers. Growers, therefore, practise intensive pesticidal spray programmes to limit losses caused by both pests and pathogens. Consequently, tomato production in the western highlands of Cameroon is both pesticide- and labour-intensive. Similar studies on potato production have indicated an intensive input of pesticides, particularly against late blight (5,15).

Pesticide usage is generally costly and constitutes a potential health hazard. Strategies, such as reduces sprays (14), field sanitation (4,9), planting resistant crop varieties (9), forecasting (8), and other less polluting methods of pest control, may be implemented to reduce high dependence on hazardous pesticides. It is, therefore, imperative to investigate on appropriate integrated pest management tactics. Moreover, tomato farmers in Cameroon need to be trained on the use of convenient protective clothing, when mixing or applying pesticides, to reduce the possibility of exposure to toxic pesticides.

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