

Maize Diseases and Pests in Burkina Faso



Authors: Mr. Bêbê MOMO, Dr. Diakalia SON, Dr. Kwame Oppong HACKMAN, Dr. Gaston T. DABIRE, Mr. Audrey Kantz Dossou CODJIA, Ms. Mélika VODOUNHESSI, Dr. Valentin OUEDRAOGO, Dr. Obed APPIAH, Dr. Kisito GANDJI, Pr. Kehinde O. OGUNJOBI, Dr. Belko Abdoul Aziz DIALLO

ABBREVIATIONS

Climate data	
PMin	Minimum precipitation (mm)
PMax	Maximum precipitation (mm)
TMin	Minimum temperature (°C)
TMax	Maximum temperature (°C)
EMin	Minimum evapotranspiration (%)
EMax	Maximum evapotranspiration (%)
VMin	Minimum wind speed (m/s)
VMax	Maximum wind speed (m/s)

INTRODUCTION

Maize is the main cereal consumed in West Africa. It is also the most energetic and economical cereal from a production point of view. In Burkina Faso, maize is grown in all regions of the country and the major production areas are located in the North Sudanian and South Sudanian zones (MARA, 2022).

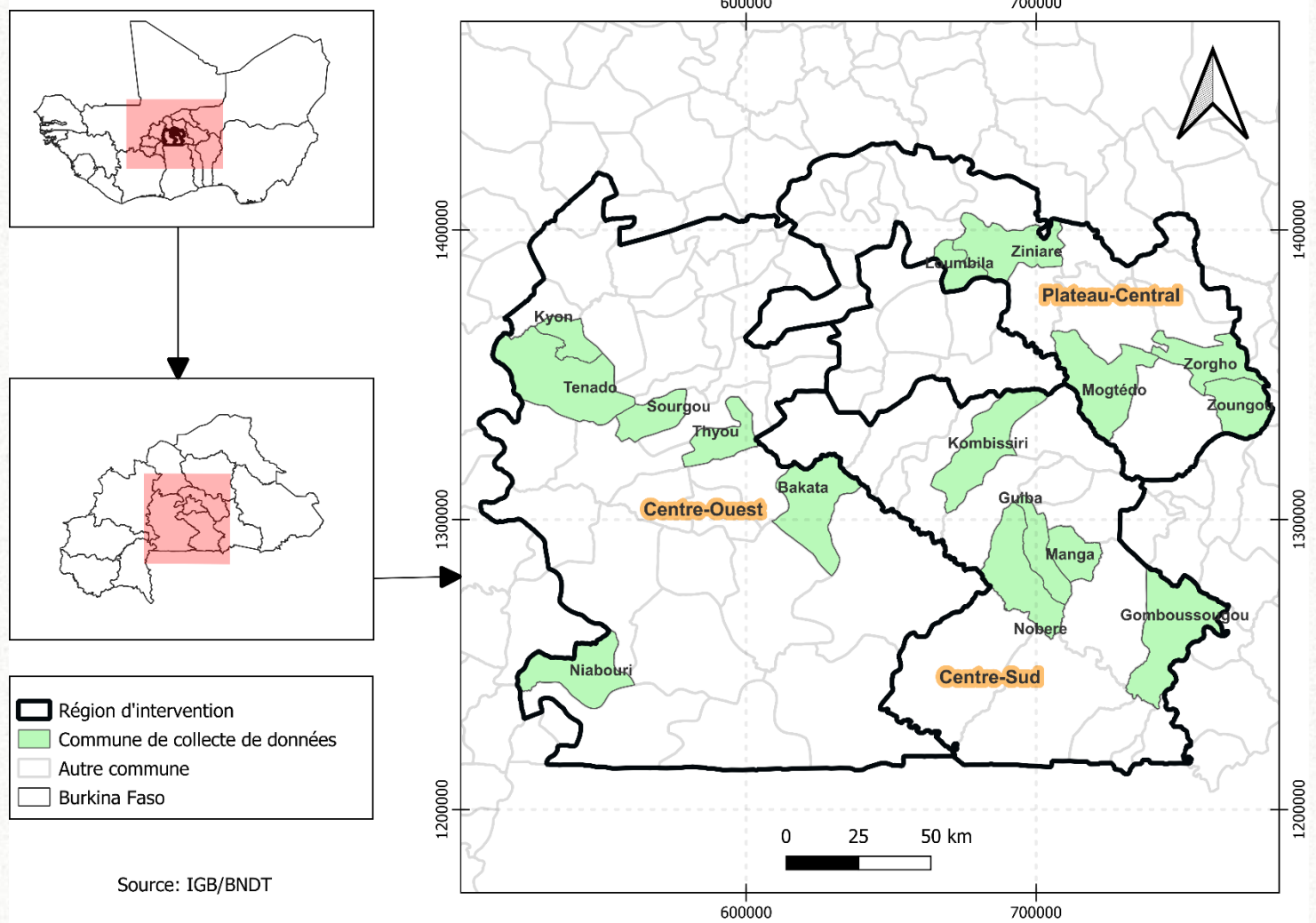
Data from the 2021/2022 agricultural season show that maize was in first place with a production of 1,533,430 tons, or 37% of national cereal production (INSD, 2023). The area sown to maize has increased by more than 19% over the past five years. They increased from 820,117 hectares in 2015 to 1,014,907 hectares in 2019 for respective productions of 1,469,612 tons and 1,710,898 tons on a potential of 9 million hectares of arable land (MARA, 2022). However, this crop faces many constraints, including attacks by pests. Among the main pests dependent on maize, the Fall armyworm (*Spodoptera frugiperda* J.E. Smith) appears to be a real threat to maize production (Sossou, 2023).

To contribute to the management of these pests, WASCAL in collaboration with the Ministry of Agriculture and Afrique Geosciences initiated the project "**Precision Pest and Disease Management System based on Multidimensional Big Data**". This project, acquired with the financial support of the European Union through the Innovation Fund of the Organization of African, Caribbean and Pacific States (OACPS), has made it possible to collect data on diseases and pests on tomato, onion and maize farms in the Centre-Ouest, Centre-Sud and Plateau-Central regions with the aim of developing digital solutions for the management of pests and diseases of these crops in Burkina Faso.

The collection took place in two phases. The first phase concerned the rainy season from July 2022 to September 2022. The second phase covered the dry season period from October 2022 to June 2023. The collection was carried out using smartphones in three regions, which are the Centre-West, Centre-South and Plateau-Central regions.

This document summarizes the main pests and diseases present in the maize fields of the study area and the different means of control.

STUDY AREA



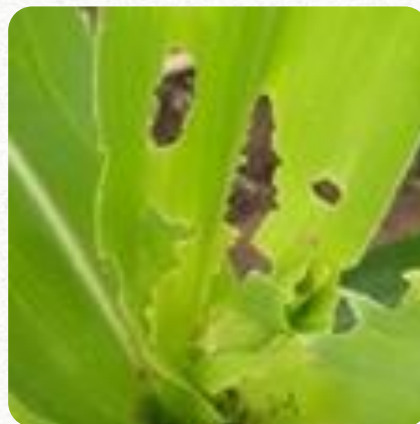
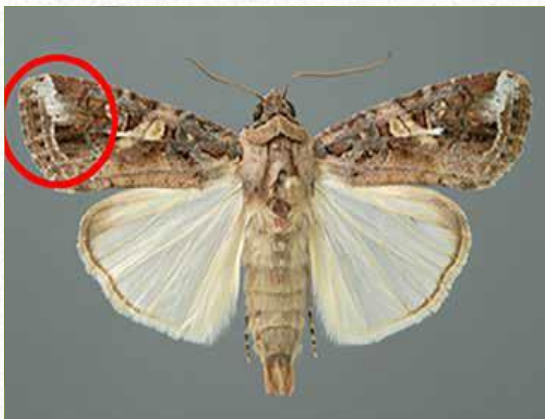
Data collection sites

MAIN PESTS (1/5)



Fall armyworm "*Spodoptera frugiperda*"

Climate data	Pmin	Pmax	Tmin	Tmax	Emin	Emax	Vmin	Vmax
	0	39.5954	23.2110	34.0935	0.0002	0.0052	0.1037	3.8379



Characteristics

The adult is a butterfly. The forewings of adult males are mottled grey-brown while females are greyish-brown and more uniform in coloration than males (Navasero et al. 2020). Eggs are laid at night on the upper or lower surface of the leaves of the host plant. They are green in colour at the time of spawning and become whitish and brown before hatching (WAN et al. 2021). The larvae are light green to dark brown in colour with longitudinal stripes. They are characterized by a white inverted y-shaped mark on the head and four (04) black spots arranged in a square on the last abdominal segment (Pransanna et al., 2018).

Feeding in the early stages of the caterpillar leaves semi-transparent patches on the leaves called "windows." It can also cause punctures, uneven borders and a build-up of droppings in the turf and upper leaves.

Young caterpillars can spin silk threads and move to a new plant using these threads, pushed by the wind (Odeyemi et al., 2021).

MAIN PESTS (2/5)



Fall armyworm "*Spodoptera frugiperda*"

Means of control

Preventive control

- Use good quality seeds;
- Visually inspect plants in the field as soon as they emerge, as the effectiveness of control depends on how quickly the attack is detected;
- Monitoring by trapping male adults through the use of sex parapheromones. A trap for an area of less than 2 ha;
- Rotations with non-host crops of *Spodoptera frugiperda*;
- Regular weeding of plots by eliminating all weeds and host plants in the plots and in the surrounding area;
- Avoid late and staggered sowing;
- Manually destroy caterpillars and egg clusters;
- Promote crop diversification and association;
- Use balanced fertilization to boost plant vigor (FAO, 2018).

Curative control

- Use authorised insecticides based on Alpha-cypermethrin, Chlorpyrifos, Diflubenzuron, Trichlorfon, Emamectin-benzoate, Indoxacarb, Lambda-cyhalothrin, Acetamiprid, Imidacloprid, Amitraz, Fenpropathrin, Fenoxycarb, Deltamethrin, Azadirachtin and Pymetrozine while following good phytosanitary practices to minimise the risk of resistance development.

MAIN PESTS (3/5)



Aphids (*Rhopalosiphum maidis*)

Climate data	Tmin	Tmax	Pmin	Pmax	Vmin	Vmax	Emin	Emax
	23.38	33.76	0	33.22	0.3515	3.4292	0.0003	0.005



Characteristics

Aphids are secondary pests of sweet corn that rarely require control in the field. However, an overabundance of these may affect pollination or the aesthetic quality of the ears (Kuo et al., 2006).

The adult corn aphid is 1.8 to 2.1 mm long and elliptical in shape. The body is blue-green, while the antennae, legs, and cornicles (small, lateral-dorsal, horn-like appendages) are black. Its antennae are short.

The larvae resemble the adult, but are smaller (0.3 to 1.5 mm). It moults four times before becoming mature. It is green, but becomes darker as it approaches maturity. Larvae, like adults, are very slow (Lu et al. 2008).

By feeding on the sap of corn, they secrete a thick, sweet liquid called honeydew. The honeydew gradually covers the parts of the maize plant where aphids are found, such as the panicle or ear paths. Sooty mold, a black mold, can then grow on the honeydew.

MAIN PESTS (4/5)



Aphids (*Rhopalosiphum maidis*)

Characteristics

Aphids can become very abundant on corn plants during dry periods. The maize aphid usually forms large colonies on the upper part of the plant (cone, leaves, ears) or on the panicle. The bicoloured cereal aphid is most often found on the husks of the ears, and sometimes on the upper surface of maize leaves. It is less frequently found on panicles.

Although rare, large aphid colonies can interfere with photosynthesis and increase water and nutritional stress in corn plants. Plants that are water-stressed can experience yield losses in the presence of aphids. Also, leaves that are heavily infested with aphids can wilt and turn yellow (Chen et al., 2019).

The presence of honeydew on sweet corn plants would be an important food source for earworm moths and other insects, attracting them and increasing egg-laying in the field.

The aphid is favoured by hot and dry weather. When the temperature is high, the aphid completes its life cycle more quickly. In addition, plants are more vulnerable to aphid attack during periods of drought or water stress. Conversely, cool temperatures, well-hydrated soils, and abundant rainfall help control aphid populations and limit their impact on the crop (Lu et al., 2008).

MAIN PESTS (5/5)



Aphids (*Rhopalosiphum maidis*)

Means of control

Preventive control

- Adults and larvae of ladybugs and stink bugs can control aphids. Ladybirds are particularly voracious: they can eat several dozen aphids per day.
- Parasitoid wasps also control aphids. The most frequently found are from the family Braconidae. They lay one egg per aphid (inside it), which becomes mummified. A new wasp comes out of each mummy, and it will parasitize other aphids. These parasitoid wasps produce several generations per year.

Curative control

- Insecticide treatments against aphids are not necessary before panicles form.
- It should be noted that aphids on the leaves do not usually cause problems. Cool temperatures and heavy rainfall help to naturally control aphid populations.
- Repeated use of insecticides can promote a sudden increase in aphids by reducing the number of their natural enemies
- If aphid populations become problematic in a particular field, a foliar insecticide based on Emamectin Benzoate can be applied.

MAIN DISEASES (1/5)



Helminthosporiose (*Helminthosporium maydis*)

Climate data	Tmin	Tmax	Pmin	Pmax	Vmin	Vmax	Emin	Emax
	31.0	33.76	31.03	33.76	1.0018	3.1316	0.0006	0.0003



Characteristics

Elongated, large, oily green spots at the beginning of the attack that turn brown. The spots become longer and cause the leaves to dry out (Brown 2004).

Conservation of disease germs: soil, crop debris.

Dissemination: by wind and water.

Developmental conditions: High doses of nitrogen can promote disease (Brown 2004).

Means of control

- Disinfection and treatment of seeds by physical means (hot water, hot air) or chemical means with fungicides.
- Avoid waterlogging of plots by appropriate cultivation methods.
- Properly reason mineral fertilization, especially nitrogen.

MAIN DISEASES (2/5)



Curvulariosis

Climate data	Tmin	Tmax	Pmin	Pmax	Vmin	Vmax	Emin	Emax
	24.21	34.09	31.86	33.76	1.6572	2.9744	0.0005	0.0004



Characteristics

- The disease causes small brown spots on the leaves surrounded by a thin yellowish layer. These spots are circular or oval in shape. The ear and stalk of maize can also be attacked (Abalo et al., 2021).
- Pathogen: *Curvularia lunata*
- Conservation: crop residues, soil.
- Dissemination: by wind and water.

Means of control

- Destruction of crop residues and practice of crop rotation.
- Disinfection and treatment of seeds with physical (hot water, hot air, etc.) or chemical means.

MAIN DISEASES (3/5)



Rust

Climate data	Tmin	Tmax	Pmin	Pmax	Vmin	Vmax	Emin	Emax
	31.01	33.76	31.003	33.76	1.002	3.14	0.0006	0.0003



Characteristics

The spots are yellow at first and become brick-red later. When touched, they dirty the hand.
Heavy rain washes away the deposit and reveals many small white spots (Quade et al., 2022).

Means of control

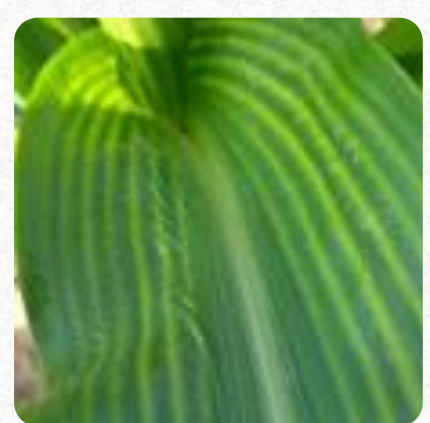
- Use tolerant varieties and organic manure;
- Rotate with resistant crops.

MAIN DISEASES (4/5)



Streak

Climate data	Tmin	Tmax	Pmin	Pmax	Vmin	Vmax	Emin	Emax
	29.7227	33.222	0	33.480	0.7548	3.4250	0.0012	0.0050



Characteristics

Stripe is a viral disease of maize transmitted by an insect called *Cicadulina mbila*, or maize leafhopper. Three main viral diseases have been reported in maize crops in tropical regions: the disease caused by Maize Streak Virus (MSV), known as **Stripe**, the disease caused by Maize Stripe Virus (MStpV) and the disease caused by Maize Mosaic Virus (MMV), known as **Stripe and Mosaic** (CYMMYT et al., 1994). Stripe caused by MSV appears as chlorotic spots on the leaves along the veins, forming discontinuous streaks of varying thickness. Affected young plants are very dwarfed. Virosis caused by MMV manifests itself as continuous, regular chlorotic lines running parallel to the veins all along the leaf blade. Symptoms can be distinguished according to the thickness of the striae, their spacing and their discontinuous appearance.

MAIN DISEASES (5/5)



Streak

Characteristics

The virus caused by MStpV can be found in two forms. The first, called stripe sensu stricto, causes the appearance of more or less wide chlorotic bands, as well as a characteristic curvature of the apex of the plant. The second form is the chlorotic stripe: chlorotic streaks form and evolve into total chlorosis with a reappearance of thick, discontinuous green streaks. Plants infected early on have a very high level of dwarfism, dry out and die.

Means of control

- Use quality seeds and resistant varieties;
- Apply early seeding to avoid coincidence between high populations and susceptible stages.
- Pull up and destroy the attacked plants.
- Use authorised insecticides based on Alpha-cypermethrin, Chlorpyrifos, Lambda-cyhalothrin, Acetamiprid, Imidacloprid while respecting good phytosanitary practices to minimise the risk of resistance development.

CONCLUSION

Photographs taken to document disease symptoms and pest damage in maize crops have enabled an inventory to be drawn up of the plant health problems encountered in the Centre-Ouest, Centre-Sud and Plateau-Central regions, both during the rainy season and the dry season of the 2022-2023 crop year. This inventory was followed by recommendations for both preventive and curative control methods. This brochure will help to improve the knowledge of supervisors and growers about maize diseases and pests, while also serving as a guide to the management of these problems in Burkina Faso.

FUNDING

This brochure has been produced as part of the implementation of the PPeDMA_S project (Precision Pest and Disease Management System based on Multidimensional Big Data). This project is part of the AGriDI initiative (Accelerating inclusive green growth through agri-based digital innovation in West Africa). Financed by the European Union through the ACP Innovation Fund of the Organization of African, Caribbean and Pacific States (OACPS), AGriDI is implemented by the International Centre of Insect Physiology and Ecology (ICIPE), within its Regional Scholarship and Innovation Fund (RSIF) coordination unit, in collaboration with the University of Abomey Calavi (Benin), the Agropolis Foundation (France) and Gearbox Pan African Network (Kenya).

REFERENCES

- Abalo Itolou Kassankogno, Gaoussou Sidibe, Abdoul Kader Guigma, Clément Bowendson Nikiema, Abdoulaye Nana et Kadidia Koita (2021). « Caractérisation des symptômes foliaires et évaluation du pouvoir pathogène de quelques isolats de *Curvularia lunata* sur trois variétés de riz (*Oryza sativa* L) produites au Burkina Faso ». *Afrique Science* 19 (4): 106-17.
- Brown, J. (2004). « Plant disease reporter, USDA » *Biologia Centrali-America* 2: v-413.
- Chen, Wenbo, Sara Shakir, Mahdiyeh Bigham, Annett Richter, Zhangjun Fei, et Georg Jander (2019). « Genome sequence of the corn leaf aphid (*Rhopalosiphum maidis* Fitch)». *GigaScience* 8 (4): 1-12. <https://doi.org/10.1093/gigascience/giz033>.
- CYMMYT, CIRAD, CORAF, IRA, INCV, INERA, IITA (1994). « Impact des viroses et les recherches actuelles ».
- FAO (2018). « Integrated Management of the Fall Armyworm on Maize», 1-133. <http://www.grainsa.co.za/upload/FAO---FAW-Guide.pdf>.
- INSD (2023). « Annuaire Statistique 2022 de la région du Burkina Faso ».
- Kuo, Mei Hwa, Ming Chih Chiu, et Jen Jiun Perng (2006). « Temperature effects on life history traits of the corn leaf aphid, *Rhopalosiphum maidis* (Homoptera: Aphididae) on corn in Taiwan ». *Applied Entomology and Zoology* 41 (1): 171-77. <https://doi.org/10.1303/aez.2006.171>.
- Lu, Wei Nung, Ya Tin Wu, et Mei Hwa Kuo (2008). « Development of species-specific primers for the identification of aphids in Taiwan ». *Applied Entomology and Zoology* 43 (1): 91-96. <https://doi.org/10.1303/aez.2008.91>.
- MARAH (2022). « Tableau de bord Statistique de l'Agriculture, des Ressources Animales et Halieutiques 2021 ».
- Navasero, Marcela M., et Mario V. Navasero (2020). « Life cycle, morphometry and natural enemies of fall armyworm, *Spodoptera frugiperda* (J.E. Smith) (*Lepidoptera*: Noctuidae) on *Zea mays* L. in the Philippines ». *Journal of the International Society for Southeast Asian Agricultural Sciences* 26 (2): 17-29.

REFERENCES

- O.O. Odeyemi, O.T. Alamu, G.A. Yekinni, et and Q.O. Oloyede-kamiyo (2021). « Development and determination of larval stages of fall armyworm on some staple crops » (4): 445-57.
- Prasanna, BM, Joseph E Huesing, Regina Eddy, et Virginia M Peschke (2018). « Fall armyworm in Africa: A guide for Integrated Pest Management ».
- Quade, Aurelie, Robert F. Park, Ben J. Stodart, et Gavin J. Ash (2022). « Urediniospores of *Puccinia sorghi*: pre- and post-cold storage requirements». Canadian Journal of Plant Pathology 44 (5): 737-43. <https://doi.org/10.1080/07060661.2022.2039962>.
- Sossou, Hervé C. (2023). « Impact of fall armyworm on maize production, livelihoods and food security », no 1: 19-24. <http://www.coraf.org/burkina-faso/?lang=fr>.
- Wan, Jing, Cong Huang, Chang you LI, Hong xu Zhou, Yong lin Ren, Zai yuan LI, Long sheng Xing, et al. (2021). « Biology, invasion and management of the agricultural invader: Fall armyworm, *Spodoptera frugiperda* (Lepidoptera: Noctuidae) ». Journal of Integrative Agriculture 20 (3): 646-63. [https://doi.org/10.1016/S2095-3119\(20\)63367-6](https://doi.org/10.1016/S2095-3119(20)63367-6).

www.ppedmas.org



Coordinating partners



icipe



Gearbox
BUILDING THINGS THAT MATTER

agropolis fondation



Funding partners



OACPS R&I

