

Original Research Article

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## Analysis of Phytosanitary Practices in Vegetable Growing with a view to the Adoption of Good Practices in the Bapla Farming Area in the South-West Region (Burkina Faso)

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### ABSTRACT

Vegetable producers on the Bapla site use a wide range of methods to manage pests on vegetable crops; however, chemical fertilisers and pesticides are used almost systematically, despite the harmful effects of these chemicals on the environment and climate change, and on the health of producers and consumers. The phytosanitary analysis carried out in this study on this production perimeter aims to take an overview of the current practices in terms of the protection of vegetable crops, with a view to adopting good practices in the protection of the crops grown there. A sample of 50 growers was surveyed using a survey questionnaire prepared with Sphinx software. The study revealed that 98% of the growers surveyed systematically use chemical pesticides to protect their produce, although 96% are aware of the toxicity of these products. Some growers use plant extracts as biopesticides from time to time. The survey reveals that only 02% use biopesticides as an alternative to chemical pesticides. 75% of the vegetable growers surveyed were aware of biopesticides, compared with 25% who were unaware of their existence. As for the effectiveness of biopesticides, 77% of those who were aware of their existence and had already used them said they were effective. The study reveals that the availability of biopesticides and the time and effort required to formulate them are constraints on their use. 72.09% of growers advocate the availability of effective biopesticides at affordable prices. At the end of this study, it emerged, firstly, that there is an urgent need for ongoing training and retraining for farmers in the rational use of chemical pesticides, and secondly, that farmers need to be made aware of the need to promote the integrated management of crop pests. This will be done by building capacity in the formulation of biopesticides effective against pests and in the application techniques for these plant protection products.

#### Keywords

Analysis, phytosanitary, biopesticide, Vegetable growing, pests and diseases

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## Introduction

Vegetable crops play an important role in human nutrition and make a significant contribution to family incomes in West Africa, but their production faces pressure from pests and diseases that limit their productivity. (Yarou *et al.*, 2017). Vegetable growing plays a key role in human nutrition and the economy in Burkina Faso. Vegetable production is practised in all regions of the country with an unequal distribution of production perimeters (PDCFL, 2017). Several crops are produced on these sites, with variations in area and production (PDCFL, 2017). The south-west is the fourth region with several vegetable growing sites, the largest of which is Bapla. Seasonal production dominates permanent production (MAH, 2011).

Vegetable growing suffers significant losses due to pests and diseases that limit yields. Like other crops, vegetable growing is subject to several phytosanitary constraints, including insect pests and diseases caused by pathogens such as nematodes, bacteria, fungi and viruses (Kanda *et al.*, 2014; Mondedji *et al.*, 2015). These pests can cause up to 100% losses if no control measures are taken. To combat these pests, vegetable growers adopt a number of cultural techniques and other plant protection methods. However, to manage these pests, chemical control using synthetic pesticides is the most common method used by growers.

They buy these products on local markets, and 90% of the pesticides used are purchased without any guarantee of conformity or quality (Son, 2017). The constant and increasing use of chemical pesticides in agriculture is a serious problem. The increasingly high levels of these residues in vegetables have disastrous consequences for the health of consumers, producers and animals (Yovo, 2010). In addition, these chemical pesticides increase the resistance of pests and micro-organisms and contribute to environmental imbalance (Mondedji *et al.*, 2015; Agboyi *et al.*, 2016). Despite the disadvantages and the harmful effects of synthetic pesticides on the environment and non-target organisms, these products still play a key role in vegetable production (Yovo, 2010).

Given the harmful effects of using chemical pesticides to treat pests and diseases, biopesticides can be an alternative to chemical pesticides. In fact, the use of biopesticides reduces or limits the use of chemical pesticides, they are less toxic than chemical pesticides, they reduce the risks of developing resistance in bio-

aggressors, and they have a highly specific action on the pest. In addition, they improve the quality of life of farm workers, and do not require any pre-harvest interval. The use of biopesticides provides consumers with healthy products that are more popular with consumers. They degrade rapidly, thereby reducing the risk of pollution (Yovo, 2010). These advantages should make pesticide-using plants indispensable phytosanitary products that are more widely used because they have no drawbacks in vegetable growing.

Despite this, biological pesticides are marginalised in the fight against bio-aggressors in market garden production (Adéoti, 2014). Knowledge of phytosanitary practices and the reasons behind their use in vegetable growing is a major concern if we are to adopt good practices in this area. This is the background to the present study on the analysis of phytosanitary practices in market garden production with a view to the adoption of good practices at the Bapla site in the South-West region.

The general objective of this study is to improve phytosanitary practices in vegetable growing at the Bapla site. This involved (i) understanding the phytosanitary practices used on the Bapla site, (ii) identifying the constraints to crop protection on the site, (iii) making recommendations for the reasoned and appropriate use of phytosanitary products in order to protect human health and for sustainable management of the land and the environment.

## Materials and Methods

### Materials Study area

The South-West is one of the country's thirteen regions, with four provinces : Bougouriba, Ioba, Nounbiel and Poni, covering an area of 1,5,633 km<sup>2</sup>. It is bordered to the north by the Hauts Bassins, Mouhoun and Centre-Ouest regions; to the south by the Ivory Coast; to the east by Ghana and the Centre-Ouest region; and to the west by the Cascades and Hauts Bassins regions.

It is one of the best-watered regions in Burkina Faso (900 and 1200 mm), with a Sudano-Guinean climate and very rough terrain (450 m) (Best Consult/ BERA, 2010). Vegetable growing is practised intensively in the region's four provinces. Hydro-agricultural dams, surface water (dams and pools) and developed lowlands are just some of the assets that encourage the development of vegetable growing in the region (Best Consult/ BERA, 2010).

## Study site

Bapla is a village located on the Gaoua-Diébouyou axis, 67 km from Gaoua. The village lies on either side of National Road N° 12 at a distance of 10 km from Diébougou. It is bordered to the north by Lokpodia, to the south by Tiankoura, to the east by the Bougouriba river, which forms the natural border with Ghana, to the west by Moutori, to the north-west by Loto (Bamba-kôh), to the south-west by Djangnan and to the south-east by Bapla Birifor.

## Choice of Study site

There were several reasons why we chose the Bapla site for our study. The site is one of the largest in the South-West region. It is irrigated by an inexhaustible water source called Bapla (dam), whose water level can be found at a depth of between 0.5 and 3 metres (Malo, 2021). This favours intense, permanent and uninterrupted production until the winter season, when rice can be grown.

## Data collection

The interviews provided us with an opportunity to get closer to the local market gardeners in order to gain an insight into their perceptions of phytosanitary practices and the use of organic pesticides. A survey was drawn up using the Sphinx software to help us carry out our surveys of producers more effectively. We conducted semi-direct interviews in order to facilitate the understanding of the market gardeners and to obtain information from them on their phytosanitary practices. This involved finding out: their level of information on existing plant treatment products, the type of plant treatment product used, the dosage of plant treatment product used, the effectiveness of the plant treatment product used, the precautions to be taken before treatment, the constraints and reasons for choosing the plant treatment products used and their adoption for treating their crops. These interviews took place over two weeks and involved a sample of fifty (50) producers from the area of production.

## Data analysis

Once the data had been collected, it was entered into Sphinx for processing and analysis. The results obtained were presented essentially in graphical form.

## Results and Discussion

### Speculations and types of pathologies encountered

Field visits and interviews with growers revealed that several crops are grown on the Bapla site. Almost all market garden crops are produced on the site, but the main ones recorded are: leaf onions, bulb onions, tomatoes, local aubergines, imported aubergines, yellow chillies, lettuce, carrots, potatoes, cucumbers, peppers, okra, courgettes and cabbage (photo 1). The market garden areas are developed to meet water requirements, with most using motorised pumps to water the crops. Water is obtained from canals supplied by the Bapla dam, which in turn is supplied by Koulbonou, which then flows into the Bougouriba. Among the difficulties encountered by growers in exploiting this site for Vegetable growing is the issue of plant health. The various crops are mainly affected by fungal, bacterial and viral diseases, followed by attacks by nematodes and other, often specific, pests which cause a great deal of damage to market garden crops.

### Pest control at production sites using chemical pesticides

This survey revealed that growers use several methods to control pests on the crops produced on the site. However, after infestations, there is systematic recourse to different types of synthetic pesticides (photo 2) and this phytosanitary control is carried out from the seedling to the last harvest.

With regard to the category of plant protection products used, the results of the analysis show that 98% of the growers on the site use chemical pesticides to control pests and diseases on their crops (Figure 4). Although some of them used biopesticides at times, chemical products were still the primary control method used by these vegetable growers. Although some vegetable growers are familiar with pesticide plants, this control method takes second place in the management of pests of their crops. The results of the analysis indicate that only 2% of them use biopesticides as an effective means of controlling crop pests (Figure 4). With regard to the phytotoxicity of chemical products, the survey reveals that around 96% of these farmers (Figure 5) are aware of their toxicity and their harmful effects on human and animal health.

## **Plant disease control at production sites using biopesticides**

### **Producers' knowledge of the existence of biopesticides as plant protection products**

The results of the analysis of the surveys indicate that biopesticides are known but used very little in market garden production on the Bapla site. Of the growers surveyed, 75.5% were aware of the existence of plants pesticides. They sometimes use plant extracts such as macerated chillies or neem leaves and kernels to control pests on their crops. On the other hand, 24.5% of the people surveyed had no idea of the existence of biopesticides (Figure 6). Producers acquired this knowledge from a variety of sources. Around 43% of them were informed by agricultural extension agents; 43% were informed by their fellow farmers and 14% by their parents (photo 3). Despite all this information, very few of them use biopesticides as an alternative to chemical pesticides.

### **Producers' knowledge of the use of biopesticides as plant treatment products**

The survey reveals that 37.8% of growers who are aware of the existence of biopesticides use pesticide plants. However, their use is not a priority, nor is it systematic in crop protection, but is used occasionally by these growers to control crop diseases. For the vast majority, it is when the all-out use of chemical products does not produce any results that they feel it is necessary to have recourse to pesticide plants. 62.2% of growers with information on the existence of biopesticides are still unwilling to apply them. In general, only 28% (figure 8) of farmers surveyed use biopesticides from time to time, compared with 72% (figure 8) who have not yet decided to use them.

### **Growers' knowledge of the effectiveness of biopesticides as plant protection products**

Our survey enabled us to gather authentic testimonies of their effectiveness from the vegetable growers interviewed who had already used biopesticides. Nearly 77% said that the use of biopesticides had proved very effective in controlling pests in their crops; 8% said that pesticide plants had proved effective in controlling pests in their crops and 15% said that biopesticides had proved less effective in controlling pests in their crops (figure 9).

## **Constraints on the use of biopesticides as plant protection products**

Despite the efficacy of biopesticides in controlling market garden pests on the Bapla site, growers occasionally use plant extracts as an alternative to chemical pesticides. There are several possible reasons for this. Our analyses show that 72% of them cite the non-availability of ready-to-use biopesticides on the market at prices they can afford (Figure 10). 27.9% cited lack of expertise in the production of plant extracts, the unavailability of ingredients for large areas, the time it takes to produce and acquire ingredients, the arduous nature of the work involved in formulation, and lack of expertise in application rates.

All these factors mean that biopesticides are still the second most widely used phytosanitary product in vegetable production. Market garden production in the Bapla site is practised by men. 100% of the farms visited are owned by men (Pooda, 2017). This could be explained by cultural factors in the South-West locality.

Analysis of phytosanitary practices in the site reveals that managing crop diseases and pests is a challenge for producers. The analysis shows that 98% of the vegetable growers interviewed use synthetic pesticides to control the pests that attack their crops. In fact, in order to protect their produce from diseases and pests, market gardeners use chemical pesticides as essential products to protect their crops (Ouedraogo 2020). Despite information on the existence of biocidal plants for crop protection, the use of biopesticides remains very limited.

This situation could be linked to a lack of expertise in the production of plant extracts, the time it takes to produce and acquire ingredients, the arduous nature of the work involved in formulation, and a lack of expertise in application doses. Added to this is the lack of training in the field, the lack of time and skilled labour for the meticulous production of aqueous extracts, and the shortage of ingredients (biocidal plants) for production in sufficient quantity and quality to cover large areas.

These constraints have been pointed out by Adekambi *et al.*, (2010) and Ouedraogo (2011). Synthetic pesticides, on the other hand, are available almost everywhere at affordable prices. In addition to being very easy to acquire, they do not require any prior work to apply, and treatment is immediate and sufficient to cover large areas during spraying.



**Figure.1** The South West region



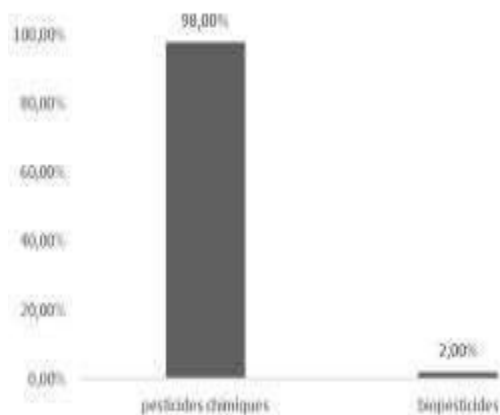
**Figure.2** Provinces in the South-West region



**Figure.3** The study site (Bapla)



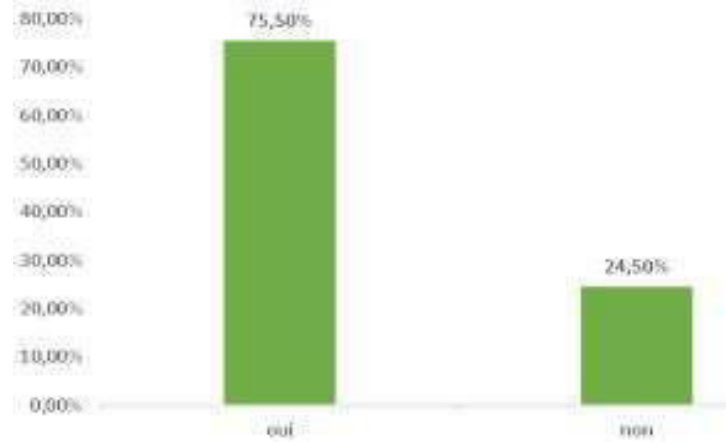
**Figure.4** Percentage of phytosanitary products used



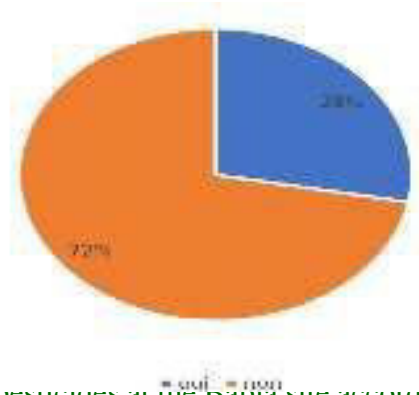
**Figure.5** Level of consciousness of the toxicity of chemical product



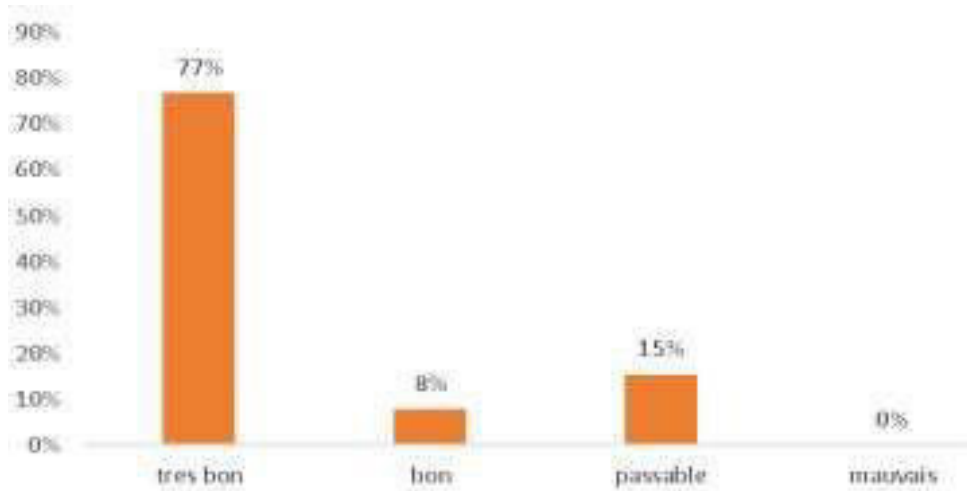
**Figure.6** Level of knowledge about biopesticides



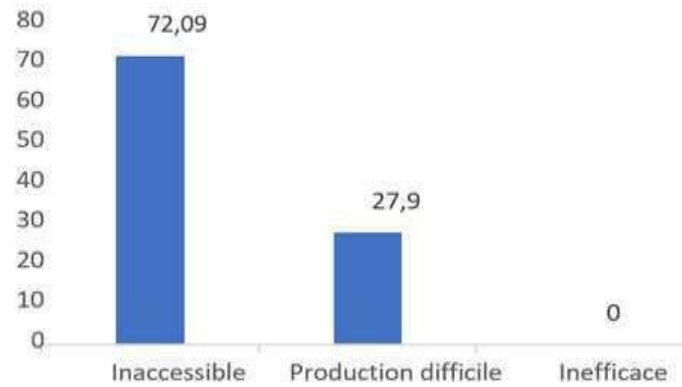
**Figure.7** Level of biopesticide use



**Figure.8** Efficacy of biopesticides at the Dapia site according to producers



**Figure.9** Constraints linked to the use of biopesticides at the Bapla site



**Photo.1** (a- onion bulb growing; b- leaf onion growing; c- growing tomatoes; d- cabbage growing)



**Photo.2** Chemical packaging already used by producers



**Photo.3** Neem leaf-based biopesticide



In such a context, biopesticides are used very little, at 02% according to the results of our surveys on the Bapla sites. Pooda (2017) also found a low rate (03%) of market gardeners using biopesticides at the Sakady and Dogona sites in Bobo-Dioulasso in the Hauts-Bassins region. Although many growers (nearly 76%) are aware of the existence of an alternative control method, i.e. biopesticides, very few growers buy from Saphyto, which sells biological pesticides.

The farmers use biopesticides as secondary crop protection products. This could be explained, on the one hand, by the difficulties associated with access to biopesticides because of their cost and, on the other hand, by their very limited knowledge of how to use these products. This means that they do not have the know-how to select and formulate aqueous extracts and essential oils, or the dosage required to apply these products to control crop pests. Some vegetable growers have no idea of the existence of organic pesticides. This would explain why biopesticides are not used in

vegetable growing on the Bapla site. The results of the survey conducted indicate that 28% of the growers met at these stations often use biological pesticides as a means of controlling crop pests. These results corroborate those of (Adeoti *et al.*, 2014) who state that 20% of the products used in vegetable growing and 5% in tomato cultivation (Son *et al.*, 2017) are of organic origin. The (72%) of producers are undecided about the use of biopesticides, which would explain their persistence in the use of chemical products in vegetable growing. These results corroborate those obtained by Adeoti *et al.*, (2014) who state that 80% of treatment products are chemical pesticides on vegetable growing. This is due to the fact that some vegetable growers (nearly 25%) have never heard of plants pesticides, and others wonder about their use and effectiveness.

Nevertheless, among those aware of plant extracts used as an alternative to chemical pesticides, almost 38% have already applied them a few times to save their crops. (85%) of growers who have used biopesticides say that



these products are very good at controlling pests on their crops. 8% of these people thought that biopesticides were good and 15% thought that biopesticides were fair. This contrasting assessment of the effectiveness of biopesticides could be explained by a lack of control over the production of biopesticide products, the under-dosing of biopesticide products, and a lack of knowledge about the periods and time intervals for treating biopesticide products. It should also be noted that biological pesticides are generally produced for specific pests, although some may have a broad spectrum of action. There are two main reasons for the limited use of organic pesticides. The first is the difficulty of producing plant-based biopesticides, according to (27.9%) of producers at the Bapla site ; the second is the difficulty of accessing and affording existing products, according to (72.09%) of vegetable growers. Unfortunately, the dissemination of plant-based pesticides remains very low (Fotio and Temwa, 2012; Pooda, 2017).

The control of diseases and other pests of market garden crops at the Bapla site is dominated by the use of chemical products. Analysis of phytosanitary practices at this site shows that biopesticides are used occasionally. Biopesticides are more commonly applied by growers when plant protection products are used indiscriminately in the event of heavy infestation of crop plots. The study shows that the widespread use of chemical products on market garden plots is due to their availability, accessibility, affordability and ability to be used over large areas. According to this study, the limited use of biopesticides as plant protection products in the treatment of diseases and pests of vegetable crops on the Bapla site can be explained by the difficulties associated with the production of plant-based biopesticides on the Bapla site, and the difficulties associated with the availability, accessibility and cost of existing plant-based pesticide products. At the end of this study, it is essential that the government departments in charge of vegetable production be approached to build producers' capacity in terms of biopesticides. This should be done through training and the dissemination of plant-based pesticides; support for producers and individuals in the production, registration and marketing of plant-based biopesticides at affordable prices.

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### Author Contribution

Dr. Fidèle Bawomon Neya, Conceived the original idea and designed the model and wrote the manuscript. M. Samin Albert Dibloni, help with data collection, entry and analysis. M. Ouedraogo Sibiri, help with data collection, entry and analysis. Prof. Kadidia Koita, help with reading, correcting and arranging the manuscript

### Data Availability

The datasets generated during and/or analyzed during the current study are available from the corresponding author on reasonable request.

### Declarations

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**Consent to Participate:** Not applicable.

**Consent to Publish:** Not applicable.

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