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Inventory of Traditional Techniques for the Wrestling of Insects in Corn Cultivation (*Zea Mays*) in Bukoma

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Abstract. This study was based on interviews with the local population. Surveys show that the population uses solar power to control insects in the conservation of corn kernels and disease-carrying insects. In addition to solar heating, people use smoke, mixing piles, ash and grain, scarecrows, hunting birds, etc. This study allowed knowing the types of traditional techniques that the population of Bukoma uses. These traditional techniques would make it possible to do without modern methods, in this case chemical methods which have already shown their effects on the environment; hence the need to promote and enhance these traditional methods.

Keywords: Inventory, Techniques, Struggle, Insects, Corn

Introduction

Globally, it is roughly estimated that 30-50% of human-managed crop production is destroyed before or after harvest by unwanted insects, diseases and weeds. Human action appears to be among the main factors responsible for the losses recorded in the cultivation of maize. People caused the acceleration of the spread of diseases by the intensification of international trade on the one hand and on the other hand by the implementation of unconscious practices aggravating these attacks (Austria, 2001).

The intensification of agricultural production is not possible without the adoption of appropriate technologies including the control of pests and diseases of crops (Savadogo et al., 2016). As a result, the low agricultural yield due to traditional methods and climatic constraints persists. It is necessary to find ways and means to deflect all these threats and particularly those of plagues on the cultivation of corn already under the weight of the precariousness of the climate (Vincent & Panneton, 2001).

This is because pest populations are increasing dramatically, increasing the severity of crop damage. Phytosanitary interventions have so far contributed to varying degrees in the control of plant pests (Calvet & Balliere, 1980). For a long time, the wrestle against crop pests and in particular those of maize cultivation has been based on the use of synthetic pesticides (Perrard, 1993). The use of these chemical pesticides has often caused many more problems than it solved. This use of synthetic pesticides poses the following major problems: Increase in insect resistance, pollution of surface water and groundwater, neutralization of soil life, cases of mortality due to pesticides, etc. (Bailly et al., 1990).

In view of the above, we asked ourselves the following question: What is the most effective traditional technique in the wrestle against the enemies of maize cultivation? To achieve our objective, our hypothesis was formulated as follows: One of the traditional inventoried control techniques would help ensure effective monitoring of cultivated land in order to avoid the introduction of new pests and / or their dispersal. The present study proposes to analyze the dynamics of pests and their impact on maize production and to draw up the endogenous strategies developed by the peasant population. Its objective is to learn about peasant techniques for combating pests. More specifically, it will analyze all the traditional methods and techniques of combating the enemies of maize cultivation.

Environment, Materials and Methods

Study Environment

The Bukoma group is located in the chiefdomm of Bwisha, in the Rutshuru territory, Province of North Kivu in the Democratic Republic of Congo. It has an area of 198 km^2 (Bwisha Chiefdom Archives, 2014). The Bukoma grouping is located between 28° 56" and 29° 42" East longitude, between 00° 42" and 1° 30" North latitude and between 900 m and 4507 m altitude with an average of 1400 m. The Bukoma group has a tropical climate. The Koppen-Geiger climate map classifies this climate as being of type Af. Bukoma has an average annual temperature of 26°C with an average annual rainfall of 1134 mm[1]. Note that only climatic constraints can lead to changes in the seasons.

The Bukoma grouping has plains made up of Quaternary alluviums which give sandy, clayey, clayey-sandy and sandy-clayey soils but they also include horizons of volcanic dust. These dusts give very permeable soils, incapable of retaining water but extremely fertile. The main types of vegetation in the Bukoma group are grassy savannas, shrub and tree savannas, sclerophyllous forests and thickets, xerophytic forests, swamps, degraded forests, cultivated fields (Ministry of Planning DRC, 2005). The Bukoma group has no or very few watercourses, but most of it is fed by the waters of Lake Edward by the Rwindi, Ishasha and Rutshuru rivers[2]. The Nguenda River to the north separates the Bukoma group and the Binza group.

Materials

Among the materials used during this study, we can cite the survey questionnaires (90), a data collection sheet, a note book, a pen, a camera, a Garmin GPS, a tape recorder, etc.

Methods

In order to carry out our research, certain methods and techniques were applied in order to collect the maximum of the necessary data. We used the static method to quantify and quantify the results in percentage, the analytical method to systematically analyze all the data collected. Among the techniques, we had used the observation technique to understand the state of play of the traditional wrestling, the survey questionnaire to be able to confirm or refute our research hypothesis, the documentation for the proper consultation of the related works, sampling for a deep study in order to have an accentuated idea on the stakes of traditional wrestling.

Results

The purpose of this part is to present the data and interpret the results obtained by the statistical approach on the one hand and to formulate the recommendations on the traditional techniques of wrestling against the enemies of the culture of corn which result from it, of the other part. To begin with, we first present the data by explaining the evolution of certain variables in the population under study.

a. Description of the sample according to the enemies of the crop

On this point, we had investigated in order to find out which enemies are the most formidable according to the opinions of our respondents.

[1] climate-data.org
[2] www.observatoire-comifac.com

Table 1. Enemies of culture

Pests of maize cultivation	*Effective*	*Frequency in %*
Diseases	0	0
Pests	35	38,89
Unwanted weeds	15	16,67
Climatic constraints	40	44,44
Other	0	0
Total	90	100

Source: Our calculations, 2017

According to this table, we see that 44.44% said that the main enemies are climatic constraints, i.e. the prolonged dry season; 38.89% say it is pests like rats (Muswa), goats, cows, etc. On the other hand, 16.67% say they are the unwanted herbs.

b. Description of the sample according to the means of control

At this point, we tried to know by what process or in what way our interviewees wrestling.

Table 2. Way to wrestle

How are you wrestling	*Effective*	*Frequency in %*
By chemicals	10	11,11
By mechanical struggle	15	16,67
By cultural practices	55	61,11
By sowing in the right season	0	0
Through biological control	0	0
Other	10	11,11
Total	90	100

Source: Our calculations, 2017

The table above shows us that 61.11% say that they wrestling by cultural practices precisely by plowing in such a way as to expose the larvae of the insects to bad weather. 16.67% say they have struggled mechanically with traps and 11.11% wrestling chemically with a product locally called Butwa. 11.11% state that they do nothing to wrestling and none of our respondents wrestling by sowing in the right season or by biological control, i.e. 0% for each case.

c. Description of the sample according to the reason for the wrestling

In this point, we tried to find out why our respondents wrestling against the enemies of maize cultivation by offering them some suggestions.

Table 3. The reason for wrestling

Why are you wrestling	*Effective*	*Frequency in %*
Increase yield	65	72,22
Produce quality seeds	0	0
Getting the quality products to sell	10	11,11
Limit potential damage	15	16,67
Other	0	0
Total	90	100

Source: Our calculations, 2017

After analysis, we could see that 72.22% admitted having struggled quite simply to increase the yield by obtaining an average of 300-400kg. 16.67% of them claim to have fought to limit the potential damage to the crop. But 11.11% say they struggle to get the quality products to sell as the market appreciates. This table also indicates that no one of our respondents struggles to produce quality seeds or for other reasons, i.e. 0%.

d. Description of the sample according to the control technique used

Depending on the control technique used, we offered our respondents some suggestions on control techniques in order to gather their opinions.

Table 4. The control technique used

Control technique used	*Effective*	*Frequency in %*
Solar heating	40	44,44
Stack, ash and grain mixture	20	22,22
Scarecrows	20	22,22
Smoke	5	5,56
Other	5	5,56
Total	90	100

Source: Our calculations, 2017

This table shows that depending on the control technique used; 44.44% uses post-harvest solar heating in intensive cultivation, which involves raising the temperature of the soil in its surface layers (up to 30 - 40 cm) for a period long enough to kill pathogenic organisms and destroy seed stocks of weeds. Others use the mixture of pile, ash and grain and others use scarecrows - 22.22% for each case.

e. Description of the sample according to the frequency of control

This point allowed us to describe our sample according to the frequency of struggle of our respondents.

Table 5. The frequency of control

Control frequency	*Effective*	*Frequency in %*
Dry or rainy season	20	22,22
Enemy invasion period	60	66,68
Possibility to wrestle	5	5,55
Market need	5	5,55
Other	0	0
Total	90	100

Source: Our calculations, 2017

This table allowed us to know on what depends the frequency of struggle of our respondents. He again shows that 66.68% say they wrestling following the period of enemy invasion 2-3 times a week in full cultivation that is, when enemies are present. 22.22% say they struggle depending on the rainy or dry season. Others say that they wrestling according to the possibility of wrestling and the necessity of the market or 5.55% for each case.

f. Description of the sample according to the consequence of the continued practice of chemical control

Any excess is bad, it is with this advice that we tried to find out from our respondents whether there is a consequence to the continued practice of chemical control.

Table 6. The consequence of the continued practice of chemical control

Consequence of chemical control	*Effective*	*Frequency in %*
Environmental pollution	10	11,11
Effect on human health	25	27,78
Habituation of Enemies	45	50
Change in soil composition	0	0
Other	10	11,11
Total	90	100

Source: Our calculations, 2017

According to this table, 27.78% say there is a consequence on human health. 11.11% say that the consequence is pollution of the environment while 11.11% do not know that there can be a consequence. But 50% say the big consequence of wrestling is the addiction of enemies to pesticides and therefore no effect.

g. Description of the sample according to the reasons linked to the non-success of the proposed techniques

At this point, we tried to establish an exhaustive list of the reasons linked to the failure of the techniques proposed before them.

Table 7. Reasons related to the non-success of the proposed techniques

Reasons linked to the non-success of the proposed technologies	*Effective*	*Frequency in %*
Their inadequacy	30	33,33
Their adoption	50	55,56
Resistant strains	0	0
Poverty	10	11,11
Other	0	0
Total	90	100

Source: Our calculations, 2017

55.56% said that the reason is the adoption of these technologies but 33.33% them say that it is the inadequacy of these technologies while 11.11% say that the reason is poverty or the 'access or power.

h. Description of the sample according to the operations before storage

Considering that even during storage there may be enemies that can attack the crop, it was important to certain operations that our interviewees do before storage.

Table 8. Operations before storage

Operation before storage	*Effective*	*Frequency in%*
Drying	50	55,56
Yard	15	16,67
Winning	25	27,77
Removal of impurities	0	0
Other	0	0
Total	90	100

Source: Our calculations, 2017

This table shows that 55.56% do the drying but 27.77% do the winnowing while 16.67% they sort the grains.

i. Description of the sample according to the control method estimated to be the best

This point helped us to gather the opinions of our respondents according to the means of struggle that they consider the best.

Table 9. Wrestling method estimated to be the best

Best estimated technique Number of people	*Effective*	*Frequency in%*
Cultural practices ales	30	33,33
Mechanical wrestling	10	11,11
Chemical control	20	22,22
Setting the traps	15	16,67
Depends on the enemy present	15	15,67
Total	90	100

Source: Our calculations, 2017

The table above shows us that 33.33% of our respondents see that cultural practices are the best technique to wrestle against the enemies of maize cultivation, among which we have drying. But 22.22% prefer chemical control and 16.67% opt for setting traps and dependence on the enemy present in each case while 11.11% are for mechanical control.

Discussion

It is difficult to control corn pests if your field is not attacked by these pests. It is from this perspective that we saw that the threat of pests is really important. The damage is of several types depending on the pest. If the field is under attack, it is important to know what kind of enemy you are dealing with because the enemies of corn are diverse (Vincent & Panneton, 2001). We see that the enemies are formidable (rats), but the most formidable are the climatic constraints that our surveyed signified in the form of a prolonged dry season (Bonnemaison, 1961). It is possible to circumvent this constraint by growing out of season if possible by irrigation (Dupriez, 2007).

There are many ways to control crop pests, but the safest way that doesn't have many constraints is proper and appropriate cultivation practices (Lougmiri, 2007). Here it is important to know the reason for the struggle (Semal & Lepoivre, 2003). The valid reason for all would be the increase in yield. But this output will have to meet the standards of quantity and quality because it is not enough to struggle to increase the output because several factors are at play such as labor and materials. Most farmers resort to solar heating to try to limit losses during storage, although other techniques are more effective.

The frequency of control is important to estimate the damage that pesticides could cause if the chemical control has been carried out on human health or on the mineral decomposition of the soil, without forgetting the habit of pests. This frequency should be moderate depending on the control technique used. In the wrestling, the consequence would be the habituation of the pests to the pesticides which will have no effect on them. Apart from that, the consequence can be manifested in the deterioration of human health and effects on environmental pollution.

The essential constraint is the adoption of these technologies. This is explained by the fact that farmers have their own way of wrestling crop pests, so the techniques offered to them are purely modern. Because they see that their traditional techniques are effective, they find it difficult to adopt new techniques. Apart from adoption, we can add the inadequacy of these techniques and poverty. The resolution to this dispute would be to introduce new techniques from their traditional techniques.

Since during storage, certain insect pests can of course destroy the stored harvest products. Therefore, it is important to take certain steps to limit or reduce the damage that these insects can cause. Various operations are applied such as drying to reduce humidity, winnowing to remove low weight impurities and then sorting and removing large weight impurities such as stones and broken grains with holes.

Nothing in the wrestling can be done without benefit at the risk of losing. Based on this idea, it is essential to point out that the best control technique depends on the enemy present in the field. This is to say that before wrestling, it is important to make the diagnosis and to identify the enemy present (De Léon, 1978). Several proposals can be given but the important thing is to wrestle against crop pests while not changing the configuration of the soil and not trying not to lose sight of the control objective, that of limiting damage while producing more.

Conclusion

The objective of this study is to know the endogenous techniques of pest control that are carried out by the population of the Bukoma group in Rutshuru territory. And more specifically to analyze all the traditional methods and techniques of struggle the enemies of maize cultivation. It was our choice to present a problem that was built around the following question: What is the most effective traditional technique in the wrestle against the enemies of maize cultivation?

To achieve our objective, our hypothesis was formulated as follows: One of the traditional inventoried control techniques would help ensure effective monitoring of cultivated land in order to avoid the introduction of new pests and / or their dispersal. To verify this hypothesis, we made use of the statistical method, the survey and the analytical method. We also used the documentary, observation, survey questionnaire and sampling technique. The results of our analysis show a significant impact of certain explanatory variables linked to traditional pest management techniques.

We came to the conclusion that pest control of maize with both traditional and modern cultural practices is more effective than mechanical control and much more than chemical control. We are convinced that the recommendations are far from constituting the only avenue for resolving the problems of traditional techniques for combating the enemies of maize cultivation due to the complexity of the issue and its socio-economic implications.

However, their implementation and the adoption of technical monitoring measures will undoubtedly make it possible to overcome the constraints of traditional control techniques in order to trace a route that can lead us to a high level of production which even contributes to the improvement of conditions of the Bukoma group.

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