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Blights of Coco-yam (*Colocasia esculentus*) and Potato (*Solanum tuberosum*) on the Jos Plateau: A Threat to Food Security

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Abstract: ***The Taro leaf blight of cocoyam and the early/late blights of potato which occurred on the Jos Plateau in recent times and their impact on the socioeconomic situation of the area have not been thoroughly assessed. The study tried to evaluate the problem from the perspective of be available research done on the problem elsewhere and exploring possible areas of employing helpful practices for the rural farmers. Some of these practices include selection of tolerant cultivars of the two crops (cocoyam and potato), early or late planting to avoid period of very high humidity, the use of wood ash and spray some botanicals as extracts of Hyptis sauveolens, neem (Azadirachta indica) and Eucalyptus spp. Spraying with effective fungicides should be more frequent and at increased concentrations as well as some cultural practices such as intercropping, adequate field sanitation and increased fertilizer rates. More permanent solutions like breeding for blight resistance, the use of biotechnology to improve the crop plants' blight resistance and tolerance can emerge with further research efforts.***

Keywords: Blights, corms, comlets, tubers, hunger-gap, incidence

1. Introduction

Coco-yam (*Colocasia esculentus*)and Potato (*Solanum tuberosum*) as well as some indigenous species of Livingstone Potato (*Plechtranthus esculentus*) and aerial yam (*Dioscorea bulbifera*) have become indigent to the people of the Jos-Plateau of Nigeria. These crops, mainly tuberous are very useful in bridging the annual/seasonal hunger-gap that sets in just before the main harvest of major food crops like sorghum, maize, yams 'chun'(*Digitaria exilis*) around July to August each year (Chuwang, 2006). Anderson *et al*., (2018) highlighted the seriousness of this seasonal hunger-gap in their analysis of farm households in Malawi and their assessment is typical of most households of Sub-Saharan Africa. In most cases, based on the prevailing farming system which had evolved around many areas of the Jos Plateau (Chuwang, 2006), when all food crops are yet to be harvested, the very survival of the poor peasant farmer and his/her family may as well depend on the potato tubers or cocoyam corms and cormlets that are dug out from the backyard and or home gardens. The situation may be so desperate that the farmers cannot afford the necessary food ingredients to ensure more elaborate preparations of these food items (potato tubers and cocoyam corms/cormletts)as a result boiling them usually suffices, and in a way, it is indicative of how dire the economic situation can become.

The season long supply chain of food for most peasant farmers in Nigeria and other parts of sub-Saharan Africa is determined by several factors interacting within the global realities like climate change, socio-economic dynamics, level of technological development and the impacts of these on environmental conditions(UNFCCC, 2011;2018; Gautam, *et al*, 2013; Das *et al*, 2016; Anderson *et al*., 2018). The so called hunger-gap(s) as identified by the World Bank and Food and Agriculture Organization (FAO) and reported by researchers (Destombes, 2006; Khandker, 2012; Anderson *et al*., 2018) is usually and most practically circumvented by the harvest of these staple crops- potato, sweet potato and cocoyam (corms/comlets) in the Jos Plateau.

The recent reported outbreaks of early and late blights of potato caused by a cork-tail of *Phytophtora infestans* and *Rhyzoctonia solani* (Bandyopadhyay *et al*., 2011, Chuwang, 2014) as well as taro (cocoyam) leaf blights (TLB) caused by *Phytophtora colocasiae* (Singh, *et al*, 2012, Adinde, *et al*., 2016), simply exasperates a very precarious situation, considering the severity of food shortages and diminishing supply along the season.

Conventional efforts to contain this scourge have proved futile because the fungicides available in the market on the Jos Plateau are ineffective in controlling the blights (Chuwang, 2014, Chuwang and Salako, 2019). Several reasons are usually advanced for none effectiveness of the chemicals to control the diseases which could be the poor administration, handling and poor quality of products (Chuwang and Salako, 2018). Other reasons may be varietal inability to adopt or cope with an increased pathogenic load in the growing area (Chuwang, 2014).

If the situation continues without any intervention, it may lead to a very serious food crisis within the study area most especially when we consider the relative poverty status of the peasant farmers. This review is aimed at assessing the problem more closely through a thorough synthesis of the diverse research ideas/ resources available into a common pool which should provide a helpful platform for further research. This could lead to the development of more effective and sustainable means of controlling the blights of potato and cocoyam.

2. Methodology

Area of Study

The Jos Plateau is characterized by Rocky hills and undulating land forms situated on an altitude of about 1400M above sea level. The total land area is approximately 8738Km^2 which covers 9 Local Government administrative unitsof Barkin-Ladi, Jos South, Jos East, Jos North, Riyom, Bassa, Bokkos and Mangu. These are the most densely populated parts of Plateau State but the rocky hills, undulating land forms as well as the fast flowing streams and rivers of the plateaumakes land availability for crop production fairly scarce.

In this paper, we basically reviewed available literature on the subject matter as it relates to the production of cocoyam and potato, the incidences of the blights, the responses of the farmers to the diseases and the suitability of these coping strategies (responses). We have also presented the most effective strategies adopted by the farmers based on the existing conditions and available information. The sources of information are scientific articles, monographs and newspaper publications.

COCO-YAM AND POTATO PRODUCTION ON THE JOS PLATEAU

The cultivation of cocoyam had been going on in this area for a very long time, and probably because of that, there are several land races of the crop in existence in these locations. The utilization of the cocoyam crop plant is fairly more extensive than that of potato which is a fairly recently introduced crop plant to the Jos Plateau (Okwonkwo *et al*, 1996).

Cocoyam Blights: The reported incidences of (TLB) caused primarily by *Phytophtora colocasiae* (Singh *et al.*, 2012)almost wiped out the crop (cocoyam) from the agricultural landscape of the Jos Plateau since the turn of the Millennium (the year 2000). The production of this essential food crop has drastically dropped since then.

The genetic variability as measured by the number of varieties and sub species available for cultivation in the area of study was very narrow prior to the incidences of the attacks of the blights. After these incidences of (TLB), the genetic variability became even narrower, to the extent that only very few hardy and resistant varieties became the cultivars of choice for cocoyam farmers. However, these cultivars do not often possess the desired yield and other agronomic components as well as nutritional qualities. Thecorm/cormlets are often tiny, hard to cook, and may cause oral and throat irritation when eaten by humans (Anon, 2016). Generally the output apart from small size and number of corm/cormlets per stand, the plant leaves that are used to make very delicious and nutritious soup are now unavailable because the (TLB) usually destroys the shoot of cocoyams (Brooks, 2005; Adinde *et al*., 2016).

This problem (TLB) has led to a significant reduction in the number of farmers engaged in the cultivation of cocoyam on the Jos Plateau to the extent that you will hardly record the conspicuous cocoyam ridges/beds in the low lying areas (‘fadamas’) or by the streams/rivers.

The cocoyam corms/cormlets which hitherto were available for sales around late July to early August seem to have completely disappeared from the markets andthis observation(s) can be directly or indirectly attributed to the recent incidences of (TLB). The economic consequences of these are quite enormous and beyond the scope of this paper. However we can observe that the July/August period is the so-called hunger-gap for most peasant farmers that form a good percentage of the population of tropical Africa generally and the Jos Plateau in particular. When food supply is threatened as it has been, during this period of cocoyam blight, then food security is also threatened.

Potato Blights: The upsurge in the reported incidences of potato blights seem to have coincided with the period when many varieties of potato were imported from Europe, the Americas and Australia (Chuwang, 2014). This assertion had led some observers to conclude that these importations were either not done following the appropriate quarantine procedures or proper adaptive field trials were not adequately carried out.

The result of all these was the severe outbreaks of both early and late blights of potato in the Potato growing areas of the Jos Plateau. The farmers simply abandoned their more adaptive and tolerant varieties for these imported varieties which produced larger tubers and significantly higher yields. There were other factors that might have contributed to these outbreaks of potato blights on the field like climate change and ineffective and poor usage of fungicides (Chuwang and Salako, 2018) but using these untested and susceptible varieties for cultivation was the major factor (Chuwang, 2014).

The implication of all these on potato production is that the yield or output of potato in the rainy season dropped so severely that the unit cost of potato tubers sold in the markets increased. This increase in cost is compounded by the poor quality of tubers available in the market like tiny ware tubers and darkened tubers that are prone to rapid deterioration in storage. Rain-fed potato which accounts for over 86% of the potato output of Nigeria (Okwonkwo *et al*., 1996) dropped very drastically (NRCRI Report 2015). There is usually an increase in production costs when farmers resort to increasing the frequency of spraying and concentration of fungicides to control the disease(s)

Coping Strategies

Options available for cocoyam Farmers: The blight that affects cocoyam starts from the leaves and rapidly spread to the entire shoot. In view of the fact that cocoyam is largely composed of leaves, the effect of the (TLB) on the crop results almost in complete yield loss therefore the farmers prefer to grow very hardy and resilient indigenous varieties that can resist or tolerate the attack of the blight causal fungi (Misra, *et al*., 2008). Some farmers have actually abandoned the cultivation of cocoyam for other more rewarding and less troubling crops like rice cultivation while others have adopted some other practices that have been tried elsewhere like delayed planting time or change in the cultivation schedule, rogueing affected plants to reduce pathogenic load and increased fertilizer application rates (Misra, *et al*.,

2008).These cultural practices hold some promise but the result of their over-all impact is not very conclusive.

The use of ashes from various sources had been advocated for by some farmers while Omeje *et al* (2018) obtained some evidence of the effectiveness of using of empty palm bunch ashes to control TLB in South Eastern Nigeria. Extracts of plants like neem, *Madhuca longifolia* and *Brassica juncea* and garlick bulb extract have been found to be effective in the control of TLB (Shakywar *et al*, 2014)

Options available for Potato farmers: In order to circumvent the problems of potato blights, farmers have shifted their attention to the dry-season cultivation where irrigation facilities are available. The low humidity of the dry season makes it very difficult for the pathogens of potato blights to thrive, however the scope of cultivation is usually restricted by the availability of water and the increased cost of production committed to lifting the water to irrigate the crops.

Potato farmers like their cocoyam counterparts have also reverted to the cultivation of older more adaptive and tolerant varieties like *nikola*, *NP*, *deseree* among others. These older/ more adaptive cultivars may be tolerant of the blights but their yields are poor compared to the newly introduced varieties.

More intensive application of fungicides have emerged due to increased frequency of spray and concentrations of the chemicals (Chuwang, 2014, Chuwang and Salako, 2018; Omeje *et al*., 2015). The proliferation and sale of adulterated low/ quality agrochemicals (Chuwang and Salako, 2019) have also compounded the problem of farmers who need to apply fungicides to control potato blights.

Some farmers interviewed said they spread wood ash to their potato leaves with some beneficial effects but this has not received any scientific investigation so the problem remains.

3. Conclusion and Suggestions

While this problem of taro leaf blight and potato blights persists, there is an urgent need to carry out the following as stop gap measures before permanent solutions are worked out.

- Preliminary trials to discover those cultivars that have tolerance and resistance to both early and light blights of potato among the new imported varieties as well as the older cultivars.
- Synchronize the cultivation of the crops in such a way as to avoid the periods of high infection of the pathogens of the blights of both potato and taro (cocoyam)
- Scientific/agronomic trials to identify and recommend the most effective fungicides and or their combinations for a more effective control of the problem.
- There is a very wide possibility of using different plant extracts as botanical disease control agents for potato and TLB. Chuwang and Odion, 2017 recorded appreciable promise while using *Hyptis souviolens* as a botanical control for potato late blight.
- Using the right type of cropping system like intercropping can help to restrict the intensity and spread of the pathogens of these diseases across the field (Chuwang, 2010).
- The use of protected growth structures like screen house, green house, tunnels and some controlled atmosphere plant growth structures is fast gaining prominence in the Jos Plateau most especially after the partnership which the state government had with an Israeli based company in the last decade.
- Biotechnology to improve the resistance of the crops to potato and taro leaf blights.
- Interim breeding programs which will set the stage for more elaborate breeding programs to produce cultivars that are not only tolerant or resistant to these plant diseases but are high yielding and of good nutritional qualities.

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