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INCIDENCE OF PRE-AND POST-HARVEST DISEASES OF SOME CROP PLANTS IN LAFIA, NASARAWA STATE, NIGERIA: THE FARMERS' FEEDBACK APPROACH

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ABSTRACT
On a global scale, plant diseases occurring on the field and after harvest have caused significant reductions in crop yield and food availability. This research was aimed at evaluating the incidence of pre- and post-harvest crop damage by pests and diseases of commonly grown crop plants in Lafia, Nasarawa State, Nigeria. Survey of disease incidence was carried out using the farmers' feedback approach via administration of semi-structured questionnaires. The report of 50 food and cash crop farmers in five different locations (Lafia North, Lafia South, Lafia West, Lafia East and Lafia Central) of the study area revealed that on-field tissue damage by insect pests had the highest mean occurrence (45.83%), and differed significantly from wilting (13.17%), leaf discolouration (11.50%), stunted growth (1.67%) and leaf necrosis (1.00%) ($P \leq 0.05$). The months of October and August were reported as having the highest incidences of pre-harvest (17.00%) and post-harvest (20.00%) diseases respectively. Differences in the incidences of crop diseases on the field and in storage were significant ($P \leq 0.05$). Findings of the study revealed that insect damage of crop tissues was the most reported cause of pre- and post-harvest crop losses, and the incidence of crop diseases were highest in the rainy reasons. Sensitization of cash crop farmers on the need for proper crop disease diagnosis and the application of appropriate control measures will help preserve yield and forestall the consequent abuse of chemical pesticides in the study area.

Keywords: Crop losses, Disease symptoms, Lafia, Post-harvest, Pre-harvest.

INTRODUCTION

Plant diseases are caused by a number of biotic and abiotic factors that reduce crop yield worldwide (El-Khoury and Makkouk, 2010). These factors include a variety of organisms such as fungi, bacteria, viruses, mycoplasmas and nematodes, as well as environmental conditions such as nutrient deficiencies and extremes in soil and atmospheric conditions etc. (Agrios, 2009). Plant diseases are estimated to cause yield reductions of almost 20% in the principal food and cash crops worldwide (Thind, 2012). In Asia, Oerke *et al.* (1994), reported that 14.2% of the potential production costing about US$ 43.8 billion is lost due to diseases. In Nigeria, crop losses amounting to millions of Naira have also been reported. For instance, Amusa and Odunbaku (2007) reported the abandonment of tomato cultivation by most communities in the humid forest of Western Nigeria due to the activities of the tomato wilt pathogen *Ralstonia (Pseudomonas) solanacearum*. Olowe (2009) also reported 20-90% yield loss in cowpea production due to infestation by root knot nematodes (*Melodogiyne incognita*) in Nigeria. Abutu (2014) reported that Nigerian farmers are undertaking agricultural profession under the mercy of the pests and rodents that eat up and consume as much crops as they desire.

The aim of this study is therefore to evaluate the incidence of pre- and post-harvest deseases of some crop plants in Lafia, Nasarawa State, Nigeria. Findings of this study shall enhance existing efforts in the integrated management of crop diseases and crop yield improvement in the study area.

MATERIALS AND METHODS

Description of Study Area

Lafia (Fig 1.) is the capital of Nasarawa State, and lies between latitude 8º25'40ºN to 8º34'15ºN and longitude 8º24'25ºE to 8º39'19ºE in the Northern Guinea Savannah Region of Nigeria. The cultivation of food and cash crops is the main stay of residents of the agrarian settlements within and around the Lafia Metropolis.

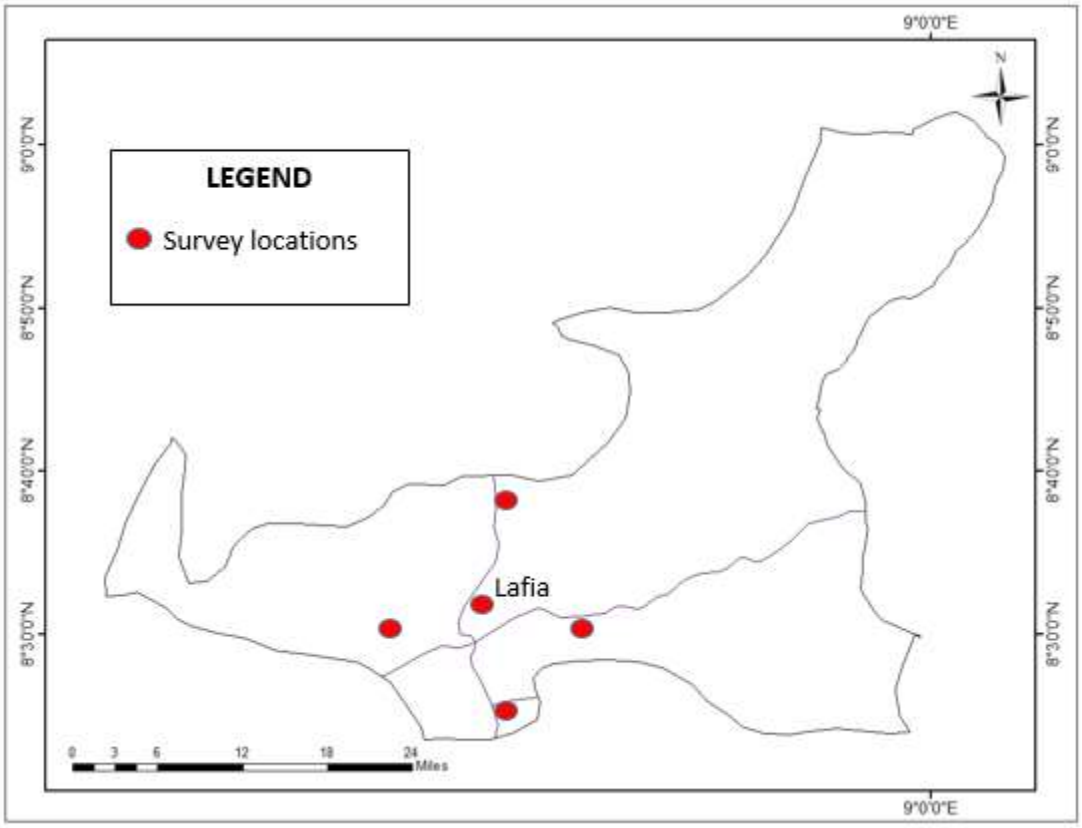

Fig. 1. Map of Lafia Local Government Area and the Study Locations

Data Collection

Data on crop disease incidence were collected via random administration of semi-structured questionnaires to a total of 50 farmers, 10 from each cardinal location of the study area (i.e. Lafia North, Lafia South, Lafia West, Lafia East and Lafia Central). The sample size per each sampling location was determined using the minimum sample size calculation formula reported by Charan and Biswas (2013) as follows:

$n = Z^2IT/p^2$

Where, n = Sample Size

Z = 1.96 (Constant at 95% Confidence Interval)

I = Expected incidence (0.59%, (Wagini and Abubakar, 2015)).

T = 1-I

p = Precision (Usually 0.05 at 95% Confidence Interval)

$$n = \frac{1.96^2 \times 0.0059\ (1-0.0059)}{0.05^2} = 9.2$$

Data Analysis

The collected data were subjected to Analysis of Variance (ANOVA) at 5% level of significance, using the IBM Statistical Package for Social Sciences (SPSS) Version 22. Means were separated using the Duncan Multiple Range Test (DMRT).

RESULTS

Results of the incidence of pre-harvest diseases of crop plants in Lafia LGA are presented in Table 1. The highest incidences of crop wilt (29.17%) and leaf discolouration (20.84%) were reported in Lafia North, while Lafia Central had the highest incidence of insect tissue damage (83.34%). Stunted growth was highest in Lafia East (8.34%), while crop plants in Lafia West had the highest incidence of leaf necrosis (5.00%). Majority of crop growers in Lafia South (70.00%) reported the absence of diseases on their crops. Insect tissue damage was the most observed in the study (45.83%), followed by wilting (13.17%), leaf discolouration (11.50%), stunted growth (1.67%) and leaf necrosis (1.00%). Differences in the incidences of different crop diseases among the studied locations were significant ($P \leq 0.05$). Insect tissue damage, discolouration of seeds and tubers, as well as seed and tuber weight loss were the only reported post-harvest disease symptoms of crop plants in the study area (Table 2).

Insect damage of harvested crop tissues was the most reported cause of post-harvest crop loss (29.33%), followed by discolouration of seeds and tubers (15.83%), and lastly seed and tuber weight loss (2.00%). Crop damage due to insect infestation was most reported in Lafia East, tissue discolouration in Lafia Central (25. 00%), and seed and tuber weight loss in Lafia South (10.00%). Differences in the occurrence of the different post-harvest disease symptoms of

crop plants were significant among the studied locations (P≤0.05).

The monthly incidence of pre-harvest crop damage by pests and diseases is presented in Table 3. The highest incidence of crop damage by diseases was reported in the month of October (17.00%), followed by June (15.00%). No pre-harvest diseases were reported in the month of September in all studied locations. Differences in incidence of pre-harvest diseases of crop plants were significant among the different months and study locations (P≤0.05).

The highest incidence of post-harvest crop damage by pests and diseases (Table 4) was reported in the month of August (20.00%), followed by December (17.50%). Post-harvest crop damage was absent in the months of April and June. Mean differences in post-harvest crop damage by pests and diseases were significant between the month of August and other months (P≤0.05).

Table 1: Incidence of Pre-Harvest Diseases of Crop Plants in Lafia LGA

	% Disease Incidence					
Pre-Harvest Disease Symptoms	Lafia North	Lafia South	Lafia West	Lafia East	Lafia Central	Average
Insect Tissue Damage	37.50^{abcd}	30.00^{abc}	20.00^{ab}	58.34^{bcd}	83.34^{d}	45.83^{c}
Wilting	29.17^{abc}	10.00^{ab}	10.00^{ab}	0.00^{a}	13.17^{ab}	13.17^{ab}
Leaf Discolouration	20.84^{ab}	0.00^{a}	20.00^{ab}	8.34^{ab}	11.50^{ab}	11.50^{ab}
Stunted Growth	0.00^{a}	0.00^{a}	0.00^{a}	8.34^{ab}	1.67^{a}	1.67^{a}
Leaf Necrosis	0.00^{a}	0.00^{a}	5.00^{a}	0.00^{a}	0.00^{a}	1.00^{a}
No Disease	25.00^{abc}	70.00^{cd}	5.00^{a}	25.00^{abc}	26.67^{b}	26.67^{b}

Means followed by different superscripts within same column are significantly different (P≤0.05).

Table 2. Incidence of Post-Harvest Diseases of Crop Plants in Lafia LGA

	% Disease Incidence					
Post-Harvest Disease symptoms	Lafia North	Lafia South	Lafia West	Lafia East	Lafia Central	Average
Insect Tissue Damage	12.50^{ab}	20.00^{ab}	35.00^{ab}	62.50^{b}	16.67^{ab}	29.33^{c}
Discolouration	8.34^{a}	20.00^{ab}	5.00^{a}	20.84^{ab}	25.00^{ab}	15.83^{ab}
Seed and Tuber Weight Loss	0.00^{a}	10.00^{a}	0.00^{a}	0.00^{a}	0.00^{a}	2.00^{a}

Means followed by different superscripts within same column are significantly different (P≤0.05).

Table 3. Monthly Incidence of Pre-Harvest Crop Damage by Pests and Diseases in Lafia LGA

	% Disease Incidence					
Month of the Year	Lafia North	Lafia South	Lafia West	Lafia East	Lafia Central	Average
January	0.00^{a}	0.00^{a}	0.00^{a}	20.84^{abc}	0.00^{a}	4.17^{a}
February	0.00^{a}	0.00^{a}	10.00^{ab}	0.00^{a}	0.00^{a}	2.00^{a}
March	0.00^{a}	0.00^{a}	0.00^{a}	0.00^{a}	8.34^{ab}	1.67^{a}
April	0.00^{a}	0.00^{a}	10.00^{ab}	0.00^{a}	16.67^{abc}	5.33^{ab}
May	12.50^{abc}	10.00^{ab}	15.00^{abc}	20.84^{abc}	20.84^{abc}	15.33^{d}
June	20.84^{abc}	30.00^{bc}	5.00^{a}	20.84^{abc}	0.00^{a}	15.33^{d}
July	16.67^{abc}	20.00^{abc}	0.00^{a}	8.34^{ab}	20.84^{abc}	13.17^{cd}
August	8.34^{ab}	30.00^{bc}	5.00^{a}	0.00^{a}	12.50^{abc}	11.17^{bcd}
September	0.00^{a}	0.00^{a}	0.00^{a}	0.00^{a}	0.00^{a}	0.00^{a}
October	33.34^{c}	10.00^{ab}	0.00^{a}	20.84^{abc}	20.84^{abc}	17.00^{d}
November	8.34^{ab}	0.00^{a}	0.00^{a}	0.00^{a}	0.00^{a}	1.67^{a}
December	0.00^{a}	0.00^{a}	5.00^{a}	0.00^{a}	0.00^{a}	1.00^{a}

Means followed by different superscripts within same column are significantly different (P≤0.05).

Table 4. Monthly Incidence of Post-Harvest Crop Damage by Pests and Diseases in Lafia LGA

Month of the Year	% Disease Incidence					
	Lafia North	Lafia South	Lafia West	Lafia East	Lafia Central	Average
January	0.00[a]	16.67[a]	8.34[a]	16.67[a]	25.00[ab]	13.34[ab]
February	0.00[a]	0.00[a]	0.00[a]	16.67[a]	25.00[ab]	8.33[ab]
March	0.00[a]	0.00[a]	0.00[a]	12.50[a]	0.00[a]	2.50[ab]
April	0.00[a]	0.00[a]	0.00[a]	0.00[a]	0.00[a]	0.00[a]
May	0.00[a]	0.00[a]	0.00[a]	0.00[a]	25.00[ab]	5.00[ab]
June	0.00[a]	0.00[a]	0.00[a]	0.00[a]	0.00[a]	0.00[a]
July	0.00[a]	0.00[a]	8.34[a]	0.00[a]	0.00[a]	1.67[a]
August	0.00[a]	41.67[d]	33.34[ab]	0.00[a]	25.00[ab]	20.00[b]
September	12.50[a]	16.67[a]	0.00[a]	25.00[ab]	0.00[a]	10.83[ab]
October	12.50[a]	0.00[a]	0.00[a]	12.50[a]	0.00[a]	5.00[ab]
November	12.50[a]	0.00[a]	0.00[a]	16.67[a]	0.00[a]	5.83[ab]
December	62.50[b]	25.00[ab]	0.00[a]	0.00[a]	0.00[a]	17.50[ab]

Means followed by different superscripts within same column are significantly different (P≤0.05).

DISCUSSION

Insect damage of crop tissues was the most reported cause of pre- and post-harvest crop losses in the study. In similar studies to estimate postharvest losses of stored grains, Kaminski and Chrstiansen (2014), and Kumar and Kalita (2017) also identified insect pests as major constraints in the grain supply chain. Boxall (2001) further mentioned that the introduction of a new insect species to Africa along with grain importation in 1980 created weight losses of up to 30% in just 3-6 months of storage. Most insect pests that constitute considerable post-harvest crop losses during storage are conveyed to storage facilities in crop produce infected on the field. Tissue damage by insect pests could be as a result of consumption of stored nutrients in infected seeds and tubers, and quality losses due to their webbing, excreta, heating, and unpleasant odours imparted to crop produce. Insects also serve as alternate hosts of other plant pathogens and also provide wounds as points of entry for phytopathogenic micro-organisms that cause crop damage.

The highest incidence of pre- and post- harvest diseases of crop plants reported between the months of August and October corresponds with the periods of adequate conditions of moisture and warm temperatures required for effective insect damage and infections by other pathogens of crop plants in the study area. This is in agreement with the reports of Eshenaur and Anderson (1997), that the prevalence of high environmental conditions of moisture and relative humidity are ideal for the development and spread of fungal, bacterial and several other plant pathogens.

Post-harvest diseases were not reported in the months of April and June. These months represent the peak of the rainy seasons in which most of the crops grown in the study area are cultivated. Very little harvest is carried out at this period of the year, and this may account for the relative absence of post-harvest diseases reported in the study.

CONCLUSION

Insect damage of crop tissues was the most reported cause of pre- and post-harvest crop losses, and although crop damage to pest and diseases were reported to occur throughout the year, incidence of crop diseases were highest in the rainy reasons. There is need to sensitize crop growers on the importance of proper crop disease diagnosis and the application of appropriate control measures in order to preserve yield and forestall the consequent abuse of chemical pesticides in the study area.

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