Effects of Purple Blotch Infection on the Proximate and Mineral Contents of Onion Leaf

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Abstract

The influence of *Alternaria porri* Ell. (Ciferri) associated with purple blotch disease in onion on the proximate and mineral composition of onion leaves was investigated. Samples of both healthy and purple blotch - infected onion leaves were dried and analyzed for the nutritional components except moisture content. The mineral contents (Na, K, Ca, P, Mg, Fe , Zn) were determined by flame photometry and atomic absorption spectrophotometry. The infected leaf showed a significant ($p < 0.05$) decrease in the quantity of the crude protein, fat, fibre and ash. The moisture content was. significantly ($p < 0.05$) lower in healthy onion leaves (88.0%) than in the infected leaves (94.7%). Similarly, carbohydrate content was lower in diseased leaves than in healthy onion leaves. The levels of minerals were significantly ($p < 0.05$) lower in diseased leaves compared to the healthy (control) leaves indicating that the infection of onion leaves by purple blotch pathogen (*Alternaria porri*) had a significant impact in reducing the nutritional value of the onion leaves. It is important to avoid fungal contamination with a view to enhance nutrient bioavailability for human consumption.

Key words: Onion leaves, Purple blotch, *Alternaria porii,* Minerals, Proximate composition.

Introduction

Onion (*Allium cepa* L.) is an important vegetable crop in Nigeria. Raw onions are consumed as young green plants or as bulbs, which are sliced or chopped. For cooking, bulbs or green onions are used. They are valued for their distinctive pungency and flavour which improve the taste of other foods. Onion either green or bulbs are used almost daily in every home and are essential ingredient in Nigerian diet (NIHORT, 1986). In some rural parts of the north, dried fermented preparations from green leaves are used to flavour foods when fresh onions are not available. The leaves are also used as supplementary feed to poultry birds, rabbits, swine and cattle. Besides the importance of accurate nutrient content of foods, the knowledge of nutrient inhibitors and enhancers are increasingly brought into focus due to their influence on bioavailability of nutrients (Abubakar and Naqvi, 1996; Mba and Akueshi, 2001). The crop is traded within and between northern and southern parts of the country on a significant scale. However, there are specific disease problems which occur when it is grown or stored (Yar adua, 2003; Dogondaji *et al*., 2005). Our food supply brings us into intimate contact with a variety of microorganisms that are present in the production and processing environments from around the world. Many microorganisms are able to grow and multiply on vegetable by using it as an energy source. The potential for foods to transmit infectious diseases is high because food safety can be compromised at so many points between farm and table. Among the diseases affecting leaves and bulbs, purple blotch incited by *Alternaria porri* Ell. [Ciferri] is the most devastating and prevalent in Nigeria (Yar adua, 2003; Abubakar *et al*., 2006). There is thus a need to react quickly to reduce the risk of new foodborne hazards that may be associated with microbial infections of onion.

The present study was undertaken to investigate the influence of purple blotch infection on the bioavailability of nutrients in onion leaf.

Material and Methods

Collection and preparation of samples

Purple blotch infected and non – infected onion leaves used in this study were obtained from Sokoto central market in Sokoto metropolis, north-western Nigeria. The leaves were washed with distilled water; these were then dried in an oven at 55^0c until constant weight was attained. Dried samples were milled separately in a waring blender and sieved through 20 – mesh sieve. Powdered samples were used for proximate and mineral analyses.

Proximate and Mineral Analyses

Standard Methods of the Association of Official Analytical Chemists (AOAC, 1998) were used for the determination of proximate composition of onion leaves. The moisture content was determined by oven drying 10g each of diseased and healthy leaf samples at 55^0C to constant weights. Ash content was obtained by incinerating leaf samples in a muffle furnace at 550^0c for 30 min. The Kjeldahl technique, which essentially determines the total Nitrogen content, was used to estimate the crude protein content. Fat content was determined gravimetrically after extraction with diethyl ether from an ammoniacal solution of the samples. Crude fibre content was determined by acid – base digestion using 1.25% H_2so_4 and 1.25% NaOH (w/v) solution, while carbohydrate value was calculated by difference. Ashed residue of leaf samples was digested with hydrochloric acid and then filtered with Whatman filter paper. The resulting solution was used for mineral analysis in triplicate (Mba and Akueshi, 2001). Sodium and Potassium were determined by flame photometry using corning 410 flame photometer (Ole *et al*, 2004). Phosphorus was determined calorimetrically with atomic absorption spectrophotometer (Jenway, 6100UK) using Phospho – vanadolybdate method. Contents of iron, zinc, calcium and magnesium were measured by atomic absorption spectrophotometer (PU 9400 X Philips Scientific, Cambridge UK). Data generated were subjected to analysis of variance (ANOVA). Where necessary, treatment means were separated using Duncan's Multiple Range Test

Results and Discussion

The mean contents of proximate and minerals in the onion leaf samples analysed in the present study are given in Tables 1 and 2 respectively on dry weight basis. The values for crude protein (9.6%), fat (3.9%) fibre (3.5%) and ash (5.2%) in healthy leaves were significantly ($p>0.05$) higher than in purple blotch infected leaves; with a crude protein content of 4.2%, fat (1.3%), fibre (2.4 %) and ash content of 3.0%. The moisture and carbohydrate contents on the other hand were found to be significantly ($p>0.05$) lower in healthy leaves than in the diseased leaves (Table 1). There were a general increase in moisture and carbohydrate contents in diseased than in healthy onion leaves. The percentage moisture content in purple blotch infected leaves increased from 88% to 94.7% in the healthy onion leaves.Similarly, the results also showed that the total carbohydrate content of the diseased leaves (83%) was significantly ($p>0.05$) higher compared to that of healthy leaves (78.8%).

Table 1: Influence of purple blotch infection on the proximate contents of the onion leaves.

Proximate (g/100g)	Infected leaf	Healthy leaf	SE $\pm$
Moisture	94.7^a	88.0^b	1.01
Crude protein	4.2^a	9.6^b	0.23
Fat	1.3^a	3.9^b	0.08
Fibre	2.4^a	3.5^b	0.12
Carbohydrate	83.0^a	78.8^b	0.89
Ash	3.0^a	5.2^b	0.12

- Values are means of triplicate determinations expressed on a dry weight basis except for moisture.

ab=Means bearing different superscript along the same raw differ ($p < 0.05$) using General Linear Model of SPSS.

The contents of Potassium, Phosphorus and Calcium were 210mg, 44.7mg and 38mg respectively for healthy leaves (Table 2). The corresponding concentrations of these elements in diseased onion leaf sample are 140mg, 38 mg and 22mg respectively. The concentrations of Magnesium, sodium, Zinc and iron in the healthy onion leaf samples are 26mg, 10mg, 2.4mg, and 0.4mg respectively compared with the 20mg, 5.4mg, 2mg and 0.2mg respectively in purple blotch infected onion leaves.The quantity of minerals was significantly higher ($p< 0.05$) healthy than in the diseased onion leaves (Table 2).

Table 2: Mineral contents of onion leaf as Influence of purple blotch infection.

Minerals (mg/100g)	Infected leaf	Healthy leaf	SE±
Potassium	210[a]	140.0[b]	4.2
Phosphorus	44.7[a]	38.0[b]	0.85
Calcium	38[a]	22.0[b]	1.08
Magnesium	26[a]	20.0[b]	0.82
Sodium	10[a]	5.4[b]	082
Zinc	2.4[a]	2.0[b]	0.17
Iron	0.4[a]	0.2[b]	0.06

- Values are means of triplicate determinations expressed on a dry weight basis.

ab=Means bearing different superscript along the same raw differ ($p < 0.05$) using General Linear Model of SPSS.

The present findings showed that proximate and mineral contents of purple blotch infected onion leaves had decreased compared with healthy uninfected leaves. This indicates that the infection of the onion leaves by *Alternaria porri* lowered significantly the nutrient composition of onion leaves. The reduction in the nutritional properties of onion leaves due to the infection by purple blotch pathogen is an evidence of utilization of proximate and mineral contents of the leaves. Previous studies indicated that pathogenic infections affect the overall level of nutritional components in a plant (Mba and Akueshi, 2001). Similarly, the mineral contents of fruits have been shown to vary tremendously with changes in infectivity caused by microbial organisms (Pathak, 1997). The significant decrease in the nutrient composition of onion leaves following infection by *Alternaria porri* is an example of such dramatic change in the chemical composition of the plants or its parts. The nutrient components generally decrease where there is a disease pressure, plants respond quickly to severe disease pressure by showing a decrease in the nutrient composition.

The higher content of moisture in the diseased leaves could be attributed to maceration of cellulose and pectin components of the cell wall by the purple blotch fungus as a possible mechanism of invasion and subsequent infection of leaf tissue. The increase in the total carbohydrate in the infected onion leaves compared to healthy leaf samples observed in this study may be due to accumulation of reducing sugars in infected leaves during pathogenesis or to lipolytic activities of the fungus or metabolism of the oil in the leaf tissue. It is also due to conversion of part of the fat into carbohydrate. The increase in carbohydrate content was found to be associated with a comparable decrease in the total oil content. Ataga and Ota (2006) observed a corresponding decrease in the utilization of the oil as a carbon source with an increase in Ether free extract in some fungi. Mba and Akueshi (2001) attributed the decrease in fat content of diseased seed to microbial enzymatic catalysis and metabolism of fat.

The onion leaves are an important source of nutrients that could alleviate malnutrition among section of the population. The study also shows that the infection of onion leaves by *A. porri* had a significant impact in reducing the nutritional value of the onion leaf. The nutritional value of leaves can be improved by ensuring the plant received adequate protection before and after harvest. Healthy, disease free, dark green leaves contain more nutrients than purple green diseased leaves.

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