INFLUENCE OF NITROGEN FERTILISATION AND STAGE OF MATURITY ON IRON LEVELS OF SPIDER PLANT (*CLEOME GYNANDRA*)

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Abstract
Iron micronutrient deficiency is still a major concern of public health significance especially in Africa and particularly in Kenya. In the current study, five different species of spider plant were obtained from the World vegetable centre in Arusha Tanzania and grown in Ruiru in Kenya. The aim was to determine the influence of nitrogen fertilization and stage of maturity on nutrient profile. The plants were raised in a split plot design, with varieties being assigned to the main plot while treatments with manure, and nitrogenous fertilizer (CAN) were assigned to the sub plots. Harvesting began four weeks after emergence of seedlings, and was done weekly for the next five weeks. Samples were prepared and analysed for minerals by atomic absorption spectrophotometer. There was a significant difference in amount of iron across the different cultivars, with MLSF17 giving the highest average amount ($p \leq 0.05$). It was followed by UGSF14, Control, UGSF36 and UGSF9 respectively. Different cultivars responded differently to nitrogen fertilization with three of them producing more iron with 1.3 g/plant nitrogen treatment while the rest had more iron with 2.6 g/plant nitrogen treatment. The stage of development was also significant, with positive correlation coefficient of 0.61 as you come to the last harvest. All these results indicate that the leaves harvested at the late stagehad a higher percentage of imbedded nutrients than others, therefore mature spider plant plants may provide a potential source of dietary iron in comparison to the early stage plants and it is therefore concluded that harvesting at the late stages is highly recommended.

Key words: *Cleome gynandra*, micronutrient deficiency, cultivars, improved agronomic practices

1 Introduction

Nutritional iron deficiency is the common cause of anaemia in the developing world. Vegetables are the important sources of these micronutrients. However, production and utilisation is still low due to poor agronomic practices such as lack of fertilizer use, lack or limited information regarding different varieties and their optimum handling and nutritional requirements during cultivation to optimise yields.

Spider plant (*Cleome gynandra* (L), Briq) is a traditional leafy vegetable consumed in Kenya, whose utilisation surveys indicate has been on the increase. Being a C_4 plant makes it well adapted to tropics and sub tropics and can be highly productive in areas under these conditions (Brown *et al.,* 2005).

In some communities expectant mothers are advised to partake largely of spider plant to boost their iron reserves which normally get depleted during pregnancy. In this study it was hypothesized that different cultivars (geneotypes) of spider plant respond differently to nitrogen supply. The objective of this study being to determine the influence of maturity and level of nitrogen fertilisation on nutrient profile particularly iron.

2 Materials and Methods

The study was carried out at the department of Food Science and Technology, in Jomo Kenyatta University of Agriculture and Technology. In this study, five different genotypes of spider plant were obtained from the World vegetable centre in Arusha Tanzania and grown in Ruiru in Kenya. The plants were raised in a split plot design, with varieties being assigned to the main plot while treatments with nitrogenous fertilizer (CAN, 26% N) were assigned to the sub plots. Harvesting by destructive sampling, began four weeks after emergence of seedlings, and thereafter done weekly for the next five weeks. Minerals were determined after dry ashing according to the method described by the AOAC (2000). The total ash obtained after ashing was boiled with 15ml of 6Nhydrochloric acid in a beaker and then filtered into a 100ml standard volumetric flask. It was then made up to the mark with deionized water.

The levels of iron (Fe) were determined by atomic absorption spectrophotometer (AAS) using standard methods. Working standards of 0, 0.5, 1.0, 1.5, 2.0 and 2.5 ppm were prepared from the standard solution by serial dilution. Each standard was aspirated into AAS and its emission and absorption, respectively was recorded to prepare a standard curve. The same procedure was applied for the prepared sample solutions for each extract and results recorded. The samples were prepared and read in triplicates. The mineral concentrations were calculated from the standard curve.

2.1 Data analysis

Analyses of variance (ANOVA) were done using Genstat version 14, with treatments and varieties as the factors. The level of significance was at $p \leq 0.05$ and mean separation was done using LSD (least significant difference).

3 Results

The varieties had no differences with N6, MLSF 17, UGSF 9, UGSF 36 and UGSF 14 which had 19.68 Mg/100 g, 20.95 mg/100 g, 19.80 mg/100 g, 21.63 mg/100 g and 19.48 mg/100 g respectively. However, these differences were not significant ($p \leq 5\%$). The average amount of iron from samples that were not treated with nitrogen fertilizer was 16.72 mg/100 g as compared to 21.71 and 22.49 mg/100 g sample for 1.3 gN/plant and 2.6 gN/plant respectively. This was highly significant with LSD value of 3.593 at 5%. Stages of maturity proved to be significant ($p \leq 0.05$) with increase from the first harvest to the third, then a drop to the fifth harvest through the fourth harvest.

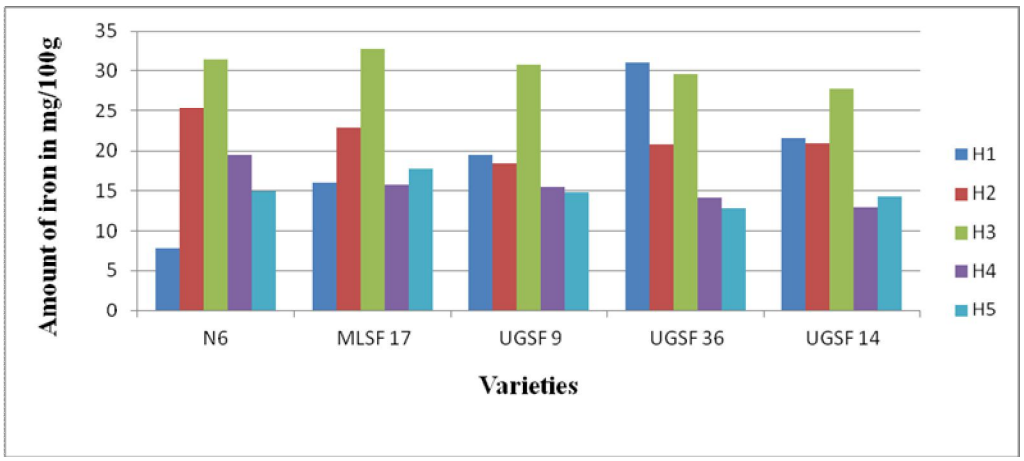

Figure 1: Amount of iron among different cultivars as influenced by the harvest stage.(H1-H5 are harvests 1-5)

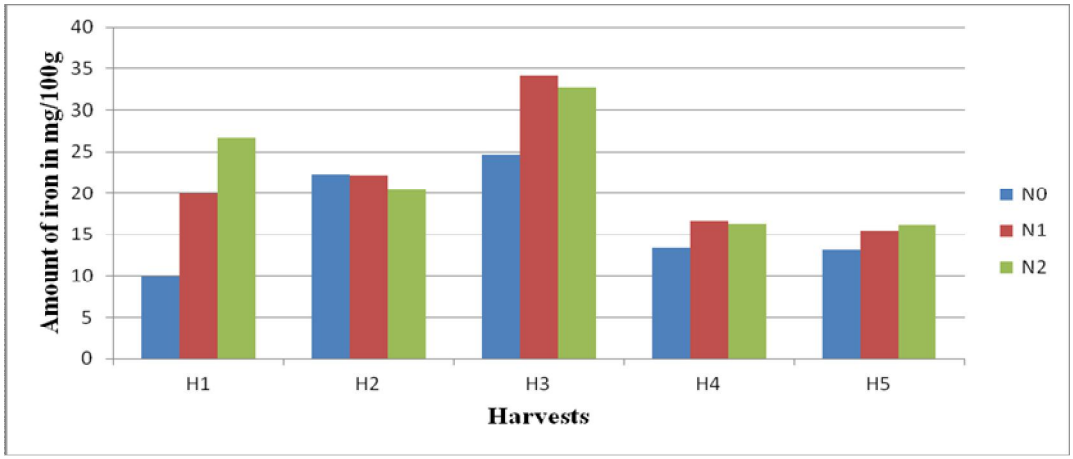

Figure 2: Amount of iron as influenced by nitrogen treatment across different harvest. Harvest 1 done 4 weeks after emergence of seedlings, 2nd after 5 weeks, 3rd after 6 weeks etc. N0= 0N/plant, N1=1.3gN/plant and N2= 2.6gN/plant)

4 Discussion

There was no significant difference in the level of iron across the cultivars. This can not be very conclusive as the genotypes could respond differently under different agro-ecological zones. The harvest stage and the level of maturity at harvest proved to be very significant ($p \leq 0.05$). However, there was a slight variation during the second harvest. This could be attributed to the nutrients in the soil and those from the first treatment; which means the cultivars need slightly more time to respond effectively to this treatment. Treatment with different levels of nitrogen fertilizer is responded to differently. With the 1.3g/plant and 2.6g/plant both significantly different from samples that had no treatment (N0), but not any different from each other (N1 and N2), they probably needed more time to effectively determine their effect.

5 Conclusions

The results of this study indicated that increasing level of nitrogen fertilisation is associated with increased levels of iron; provided the plant is allowed sufficient time to mature. Mid harvests proved to be the most optimum time to derive the maximum nutrition to alleviate the iron deficiency anaemia. Growers are advised to improve their agronomic practices such as use of fertilizer. This study presents data that attests to the importance of monitoring the growth of spider plant across the life cycle.

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