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Short Communication

Effects of graded nitrogen levels on leaf nitrogen content of cordyline (*Cordyline fruticosa* var. 'purple compacta') in Batticaloa district, Sri Lanka

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Abstract

Cordyline is a famous foliage plant with great demand in the global markets as cut decorative foliage. Nitrogen has significant effects on the leaf nitrogen content of foliage plants. A shade house (50%) experiment was carried out to determine the effects of graded nitrogen levels on the leaf nitrogen content of cordyline (Cordyline fruticosa, variety 'purple compacta') plants in the Eastern University, Sri Lanka from July 2017 to November 2017. Completely randomized design was used as experimental arrangement. Five treatments were defined viz. 0.5(T1), 1.0 (T2), 1.5 (T3), 2.0 (T4) and 2.5 (T5) g nitrogen/plant/month (g/p/m) and each treatment consisted of twenty replications. Phosphorous and Potassium levels were kept constant throughout the experiment. Urea was used as a nitrogen source. Urea was applied at monthly interval as a split application. Agronomic practices were done uniformly for all treatments according to the recommendations. Leaf nitrogen content was measured by SPAD meter at monthly interval. Measured data was analysed significantly ($p < 0.05$) by performing Analysis of Variance to determine significant differences among treatments. Results shown that plants belong to T1 (nitrogen level 0.5g/p/m) showed significantly ($p < 0.05$) higher leaf nitrogen content (SPAD value), while the lowest leaf nitrogen content was observed in T5 at 3 months after transplanting. From this study, it was found that, leaf nitrogen content decreased with increasing level of nitrogen application in Cordyline fruticosa var. 'purple compacta' at 50% shade level.

Keywords: Foliage plant, leaf nitrogen content, shade house, SPAD value.

Introduction

Cordyline (*Cordyline fruticosa* var. 'purple compacta') is a popular foliage plant belongs to family Asparagaceae. Popularity of cordyline is attributed by vigorous vegetative growth and leaf colour[1]. Ahmed *et al.*[2] stated that the nitrogen is the major nutrient required for optimum growth of a plant. Nitrogen is the main component of chlorophyll and anthocyanin. Optimum leaf chlorophyll content is essential for the high photosynthetic rate and biomass production. All proteins consist of nitrogen. Therefore, it encourages rapid vegetative growth. Anthocyanin is a pigment that causes purple colour in foliage of cordyline[3]. Hence, optimum leaf nitrogen content is essential for the vigorous vegetative growth and better-quality foliage.

Leaf nitrogen content would be higher at optimum nitrogen level as high absorption of nitrogen from the soil. In sugar cane plants, high nitrogen concentration was observed in leaves at optimum nitrogen level while lowest leaf nitrogen concentrations were noticed at lower and higher nitrogen application[4]. The leaf nitrogen content has a significant correlation with the different levels of nitrogen applications. In *Fallopia sachalinensis,* there was a positive correlation observed in leaf nitrogen content with the optimum nitrogen level[5]. Minu Singh *et al.*[6] opined that increasing nitrogen up to 120kg/ha increased the nitrogen content of leaves whiles the application of 0kg (Control) and 160kg N/ha caused a decrease in the leaf nitrogen content of *Zingiber officinale* Rosc.

Therefore objective of this experiment was to evaluate the effects of different nitrogen levels on leaf nitrogen content of *Cordyline fruticosa* variety, 'purple compacta' at 50% shade level in the Batticaloa district, Sri Lanka.

Materials and methods

A shade house experiment was done from July to November 2017 at the Crop Farm of Eastern University, Vantharumoolai, (7.7944° N, 81.5790° E) located in low country dry zone of Sri Lanka. Cordyline (*Cordyline fruticosa* variety, 'purple compacta') required 50% of optimum shade level for the cultivation in Batticaloa district[7]. Completely randomized design (CRD) was used as experimental arrangement. Different amounts of nitrogen were defined as treatments viz. 0.5 (T1), 1.0 (T2), 1.5 (T3), 2.0 (T4) and 2.5 (T5) g of Nitrogen/ Plant/ Month. Each treatment contained 20 replications. An experimental unit contained of one plant. Split application of nitrogen was practiced. Urea was used as a nitrogen source in this experiment. 15cm × 15cm spacing was practiced. Uniform sized (20cm), rooted and one-month old, soft wood cuttings of cordyline (*Cordyline fruticosa* variety, 'purple compacta') were

used as planting materials. The rooted cuttings were planted in polybags (diameter and height of the bags were 10 and 15 centimetres respectively) filled with potting media consists of compost and top soil in a ratio of 1: 1 (volume basis). Nitrogen fertilizer application was done according to the treatment structure. Potassium and Phosphorous was applied at the recommended and fixed rates (1.0g/plant/month and 0.5g/plant/month respectively) (Department of Agriculture, 2002). All other recommended agronomic practices were done uniformly for all treatments suggested by Department of National Botanic Gardens, Sri Lanka. Plants were sampled monthly in all treatments during the experiment. SPAD values were measured by a portable SPAD meter (Model: SPAD-502, Minolta crop, Ramsey, NJ).

Plate-1: Measurement of SPAD value with portable SPAD502 meter.

Statistical Analysis System (SAS) was used to perform Analysis of Variance to define significant ($p<0.05$) differences among treatments. Tukey's test was used for the comparison of treatment means at the 0.05 probability level.

Results and discussion

Leaf nitrogen content of cordyline (*Cordyline fruticosa* var. 'purple compacta') was significantly ($p<0.05$) influenced by graded nitrogen levels (Figure-1). Leaf nitrogen content was significantly ($p<0.05$) higher in treatment 1 (T1) compared with other treatments at 3 months after transplanting (MAT).

Influence of different nitrogen levels on leaf nitrogen content was first noticeable at one month after transplanting and difference among treatments was observed throughout the experimental period. Plants grown at nitrogen level 0.5 g/plant/month (g/p/m) had significantly ($p<0.05$) highest leaf nitrogen content (SPAD value-72.5) among all treatments, while lowest leaf nitrogen content (SPAD value-43.6) was recorded in T5 at 3 MAT.

Cordyline plants had highest leaf nitrogen content in T1 than other treatments at 3 MAT. Nutritional condition of the plant has the close relation with the nitrogen present in the plant leaves. Higher leaf nitrogen level indicates a healthier plant [8]. Plants grown at this nitrogen level would have received optimum level of nitrogen. Optimum amount of nitrogen fertilizer could enhance the nitrogen uptake in plants. This increase has a positive result on leaf nitrogen content also subsequently increases the plant growth. Muchow and Sinclair[9] also mentioned that leaf photosynthetic capacity and leaf nitrogen content has a close correlation. Evans[10] stated that a large proportion of total leaf nitrogen is made up of proteins which were used in the photosynthesis. The major part of leaf nitrogen is present in chlorophyll molecules and a close connection between leaf chlorophyll content and leaf nitrogen[11]. Evans[12] revealed that leaf chlorophyll content is nearly proportional to nitrogen content in leaves. It is reasonable as structural element of chlorophyll and protein molecules is the nitrogen, and thereby formation of chloroplasts and accumulation of chlorophyll in them were affected[13,14]. Hence, optimum level of nitrogen application in T1 enhances leaf nitrogen content. These could be the reasons for highest leaf nitrogen content observed in plants grown at nitrogen level 0.5 g/p/m at 3 MAT.

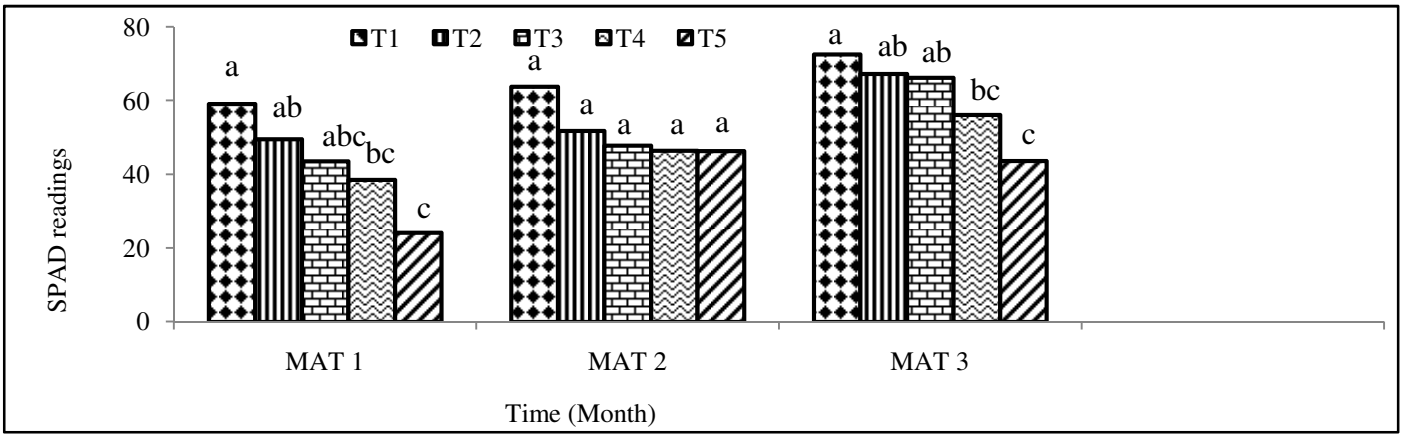

Figure-1: Effect of graded nitrogen levels on leaf nitrogen content (SPAD value) of cordyline (*C.fruticosa* var. 'purple compacta') at 1, 2 and 3 months after transplanting. Bars on the graph with the same letter are not significantly different according to the Tukey's test at 5% level of probability. (n=3).

Cordyline plants grown at nitrogen level 2.5g/p/m had lowest leaf nitrogen content than other treatments at 3 MAT. Onyango[15] stated that the osmotic potential of the soil solution is increased by high level of soluble nitrogen, and leads to reduction in water uptake by the plant roots. Therefore, it could reduce the absorption of nitrogen as well. Hence, higher level of nitrogen would be toxic to the plants. Toxic level of nitrogen fertilizer reduced nitrogen uptake by plants. This decrease has a negative result on leaf nitrogen content and leads to the reduced plant growth. Britto and Kronzucker[16] also opined that nitrogen toxicity cause growth suppression in plants. These could be the reasons for lowest leaf nitrogen content noticed in plants grown in T5 at 3 MAT.

It could be stated that leaf nitrogen content of cordyline plants decreased with increasing level of nitrogen in this experiment. Debaeke *et al*.[17] pointed out that increasing nitrogen up to 75 kg ha^{-1} increased the leaf nitrogen content of rice cultivar ('hang 43') while the application of 150, 225, 300 and 375 kg ha^{-1} caused a decrease in the leaf nitrogen content.

Conclusion

Cordyline plants grown at 0.5 g/plant/month nitrogen level had highest leaf nitrogen content while lowest nitrogen content was recorded in 2.5 g/plant/month. Leaf nitrogen content of *Cordyline fruticosa* var. 'purple compacta' decreased with increasing level of nitrogen in this study.

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