

Original Research Article

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Impact of Heading Back and Pinching on Mineral Status of Moringa Leaves (*Moringa oleifera* Lam. Cv. PKM-1)

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ABSTRACT

Keywords

Moringa, Heading back, Pruning, Nitrogen, Phosphorous, Potassium, Calcium, Magnesium

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A field experiment was conducted to study the changes in mineral status of moringa leaves after heading back and pinching treatments. Three heading back treatments and three pinching treatments were imposed on the moringa trees. The intensity of heading back and time of pruning is crucial for the stability of the tree, proper light penetration and nutrient uptake. Less intensive heading back at 70 cm above the ground level is beneficial in the uptake of N, P, Ca and Mg. Early pruning at 60 days after heading back increased the uptake of mobile nutrients P, K and Mg while pruning at 80 days after heading back influenced the N uptake and late pruning at 100 days after heading back stimulated the higher accumulation of Ca in moringa leaves. In the interaction effect also heading back 70 cm with pinching at 60 days is beneficial to increase the mineral content (N, P, K, Mg) of annual moringa leaves except for calcium that prefers late pruning at 100 days after heading back.

Introduction

Moringa (*Moringa oleifera* Lam.) popularly called as the 'drumstick tree' is an indigenous vegetable, has gained its importance due to its nutraceutical values and considered as an indispensable plant for health management. It

is one of the most incredible plants to the mankind and its nutritional and medicinal properties have immense potential to manage malnutrition (Gopalakrishnan *et al.*, 2016). The genus Moringa consists of 13 species but the most popular and cultivated type is *Moringa oleifera*, which is spread over in

tropical and sub-tropical regions and adopts well in different soils and adjust well even in marginal conditions. The ability of this crop to survive adverse conditions made this crop to spread wide in various regions. This fast growing, small to medium sized tree is used as an animal forage, source of nutrition, medicine, water purification, cosmetics even as bio fuel.

Moringa is a pruning responsive crop and flowers in current season growth. Pruning is a prerequisite to maintain the proper canopy size and shape. Pruning also provides opportunity for easy harvest and increased quality content in moringa. Pruning in moringa removes the unproductive growth and helps to exploit its potential to a greater extent. Pruning also induces notable changes in the nutritional content of leaves and pods in moringa. The present study was carried out to find the effect of different stages of heading back and pinching on the mineral status of moringa leaves.

Materials and Methods

The trail was conducted at Department of Vegetable Science, Horticultural College and Research, Periyakulam, during 2018-19. The experiment was laid out in split plot design with two replications. Seeds of moringa cv. PKM-1 were sown in an area of 0.63 acre with a spacing of 3 m x 3m. The main plot was imposed with heading back treatment and the sub-plot was with pinching treatments. The main-plot treatments include heading back at 30 cm (M_1), 50 cm (M_2) and 70 cm (M_3) above the ground level whereas the sub-plot treatments are pinching at 60 days (S_1), 80 days(S_2) and 100 days(S_3) after heading back.

The minerals status of the leaves was assessed at the vegetative stage after the completion of pinching treatments. The leaves were

collected from five randomly selected trees of each treatment in each replication and used for analysis. The nitrogen content of the leaves was estimated by microkjeldahl block digestion and steam distillation method. Phosphorous was assessed in phosphoric vanadomolybdate yellow colour method, potassium in flame photometer, calcium by EDTA method and magnesium by versanate method. The data's obtained were statistically analysed as per the methods of Panse and Sukhatme (1967) using agres statistical software.

Results and Discussion

Nitrogen content

The nitrogen content was highest in 70 cm(M_3) heading back (2.82 %), pinching at 80 days (S_3)after heading back (2.81 %) and in the interaction M_3S_2 (heading back at 70 cm followed by pinching at 60 days) with 2.87 % (Table 1). The lowest nitrogen content was recorded in 50 cm(M_1) headed back trees (2.46 %).Heading back at 70 cm and pinching at early stage enhances the number of branches which ultimately increased the nutrient uptake and translocation through transpirational pull. The results were in accordance with Thokchom *et al.*, (2018) in apricot.

Mobility of nitrogen also aided its accumulation in increased vegetative growth (Kaith *et al.*, 2011) resulted by the interaction of top heading back and early pinching in moringa. The result is in conformity with the findings of Cheng and Raba (2009) in apple

Phosphorous content

The main-plot treatment M_1 (heading back at 30 cm) and M_3 of heading back at 70 cm (0.020 %) and the sub-plot treatment S_1 (0.022 %) recorded the highest phosphorous

content (Table 2). The interaction of 70 cm headed plants with pinching at 60 days (M₃S₂) recorded the highest phosphorous content of 0.026 %. Phosphorous content increases in severely pruned trees as it increases number of shoots and acted as active sink for nutrient (Singh *et al.*, 2009). Much differences were

not observed in the phosphorous content among the treatments could be possibly due to antagonism between the anions of nitrate and phosphate in the adsorption site as reported early by Sharma and Singh (1982) in peach and Kaith *et al.*, (2011) in apple.

Table.1 Effect of heading back and pinching on Nitrogen (%) content of leaves

Treatments	S ₁	S ₂	S ₃	S ₄	Mean
M1	2.53	2.67	2.75	2.64	2.64
M2	2.46	2.76	2.85	2.60	2.67
M3	2.78	2.87	2.83	2.80	2.82
MEAN	2.59	2.77	2.81	2.68	2.71
				SE(d)	CD @ 5%
M – Main plot				0.026	0.112
S – Sub plot				0.027	0.060
M @S				0.048	0.137
S @ M				0.046	0.104

Table.2 Effect of heading back and pinching on Phosphorous (%) content of leaves

TREATMENTS	S ₁	S ₂	S ₃	S ₄	MEAN
M1	0.015	0.020	0.025	0.019	0.020
M2	0.017	0.020	0.018	0.014	0.017
M3	0.015	0.026	0.017	0.021	0.020
MEAN	0.016	0.022	0.020	0.018	0.019
				SE(d)	CD @ 5%
M – Main plot				0.000	0.002
S – Sub plot				0.001	0.002
M @S				0.002	0.004
S @ M				0.002	0.004

Table.3 Effect of heading back and pinching on Potassium (mg 100 g⁻¹) content of leaves

Treatments	S ₁	S ₂	S ₃	S ₄	Mean
M1	63.30	69.14	65.68	65.96	66.02
M2	59.15	70.20	67.31	70.10	66.69
M3	58.57	70.63	68.75	69.69	66.91
MEAN	60.34	69.99	67.24	68.58	66.54
				SE(d)	CD @ 5%
M – Main plot				0.58	NS
S – Sub plot				0.43	0.97
M @S				0.86	2.74
S @ M				0.74	1.67

Table.4 Effect of heading back and pinching on Calcium (%) content of leaves

Treatments	S ₁	S ₂	S ₃	S ₄	Mean
M1	1.76	1.86	1.59	1.60	1.70
M2	1.23	1.93	2.10	2.33	1.89
M3	2.15	1.99	2.08	2.52	2.18
MEAN	1.71	1.93	1.92	2.15	1.93
				SE(d)	CD @ 5%
M – Main plot				0.019	0.084
S – Sub plot				0.037	0.084
M @S				0.059	0.147
S @ M				0.065	0.146

Table.5 Effect of heading back and pinching on Magnesium (%) content of leaves

Treatments	S ₁	S ₂	S ₃	S ₄	MEAN
M1	0.63	0.87	0.72	0.92	0.78
M2	0.83	0.63	0.74	0.51	0.68
M3	0.68	0.89	0.81	0.92	0.82
MEAN	0.71	0.80	0.76	0.78	0.76
				SE(d)	CD @ 5%
M – Main plot				0.009	NS
S – Sub plot				0.008	0.018
M @S				0.015	0.044
S @ M				0.013	0.031

Potassium content

Potassium content of moringa leaves were not much affected by heading back treatments (Table 3). Pinching at 60 days after heading back (69.99 mg/100 g) and interaction M₃S₂ of 70 cm heading back with pinching at 60 days (70.63 mg /100g) recorded the highest amount of potassium. The interaction of heading back and early pinching increased the K content due to vigorous growth and less accumulation of dry mater. The results were in accordance with the findings of Jayswal *et al.*, (2017) in guava and Khaosumain *et al.*, (2013) in longan.

Calcium content

Heading back at 70 cm (M₃–2.18 %), pinching at 100 days (S₄)after heading back

(2.15 %) and in the interaction M₃S₄ (heading back at 70 cm followed by pinching at 100 days) with 2.52 % recorded the highest Ca content. Ca translocation lag behind the water movement in mass flow (Bangerth, 1979). The immobility of Ca reduces the deposition in heavily pruned trees than the slight pinched trees at 100 days after heading back. The results confirm the findings of Singh *et al.*, (2010) in mango and Kumar and Thakur (2012) in plum (Table 4).

Magnesium content

Pinching and the interaction of heading back with pinching treatments induced significant variations in magnesium content of moringa leaves. Pinching at 60 days (S₂) after heading back (0.80 %) and interaction M₃S₄ of 70 cm heading back with pinching at 100 days (0.92

%) recorded the highest amount of magnesium. Magnesium content availability in leaves depends on the severity of pruning. Less intensive heading back and pinching enhanced the amount of Mg in leaves. The findings were in line up with the results of Rutkowski *et al.*, (2018) in sour cherry (Table 5).

In conclusion the mineral content availability in leaves are related to the intensiveness of pruning and their mobility status. Less intensive heading back combined with intensive pinching promotes the vegetative growth. The vegetative growth ultimately increased the sink availability for the deposition of minerals. Hence, heading back at 70 cm with pinching at 60 days after heading back can be adopted to increase the leaf mineral content which is essential on the nutritional content of moringa leaves for its various uses.

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