

Original Research Article

<https://doi.org/10.20546/ijcmas.2019.802.309>

Effect of Canopy Management and Chemical Manipulation on Morphological Attributes of Off Season Production in *Annual moringa cv. PKM1*

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ABSTRACT

Keywords

Annual moringa,
Canopy
management,
Chemical,
Manipulation

Article Info

Accepted:
20 January 2019
Available Online:
10 February 2019

A field experiment was conducted at Krishi Vigyan Kendra farm, Veterinary College and Research Institute Campus, Namakkal, Tamil Nadu during 2012 - 2014 to study the influence of Canopy management and chemical manipulation on morphological attributes of off season production in annual moringa cv. PKM 1. The technical programme comprised of two levels of mulching, three pruning levels and three levels of chemical spray (sprayed twice at one and two months after pruning). Among the three different combinations studied, the combination Black polyethylene mulch + July pruning + water spray registered the maximum plant height (3.96 m). Regarding number of branches, the black polyethylene mulch recorded the highest number of primary branches / tree (6.27). In case of pruning treatments, July pruning recorded the highest number of primary branches per tree (5.90). Among the growth retardants, uniconazole 50ppm spray produced more number of primary branches (5.31).

Introduction

Moringa (*Moringa oleifera* Lam.) popularly called as the “drumstick tree which 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,

and prevent and heal any maladies. This fast growing, small to medium sized tree is used as animal forage, source of nutrition, medicine, water purification, cosmetics even as biofuel. India is the largest producer of moringa with an annual production of 1.1 to 1.3 million tonnes of tender fruits from an area of 38,000 ha. Andhrapradesh leads in both area and Production (15,665 ha), followed by Karnataka (10,280 ha) and Tamil Nadu (7,408 ha), whereas other states

occupies an area of 4,613 ha only. In Tamil Nadu both perennial and annual moringa varieties are cultivated. Regulation of morphological attributes by increasing root zone temperature as well as to prevent the entry of rain water using black polyethylene film mulch, pruning in a right season and foliar application of growth retardants in such a way maximum flowering can be induced in rainy and winter season in order to get yield during off season. The optimum pruning provides better condition for light, nutrition and moisture for plant growth, which results in timely commencement of reproductive phase and thus, formation of more fruits. The growth retardants are known for their effects of suppressing vegetative growth and inducing flowering in crop plants. Hence the present investigation was carried out with a view to find out the effect of canopy management practices and chemical manipulation on morphological attributes of off season production in Annual Moringa cv.PKM1.

Materials and Methods

A field experiment was conducted at Krishi Vigyan Kendra farm, Veterinary College and Research Institute campus, TANUVAS, Namakkal during August 2012 to March 2014 to study the influence of canopy management and chemical manipulation on morphological attributes in off season production of Annual moringa cv.PKM1. The experimental site is geographically situated in North western agro-climatic zone of Tamil Nadu at 11° North latitude and 77° East longitude at an altitude of 300 m above MSL.

The mean annual rainfall of Namakkal (mean of 30 years) is 771 mm distributed over 47 rainy days. The mean maximum and minimum temperatures are 31.5 and 21.4°C, respectively. The relative humidity ranges from 61 to 91 per cent at 07.22 hrs and 41 to

68 per cent at 14.22 hrs. The mean bright sunshine hour day⁻¹ was 7.4 with a mean solar radiation of 429 cal cm⁻² min⁻¹. The soil of the experimental site was red sandy loam in texture with a pH of 7.16, available nitrogen, available phosphorus and available potassium. The experiment was laid out in Factorial Randomized Block design with 3 factors in two replications.

Results and Discussion

The important morphological characters that influence the development and productivity of a crop are plant height and number of branches. These morphological parameters were differentially influenced by mulching, different months of pruning and chemical spray treatments.

Plant height at 120 days after pruning

Influence of mulching, pruning and chemical spray on plant height showed highly significant effect during off season (Table 1).

Mulching (M)

The plant height at 120 days after pruning exhibited significant difference with regard to mulching. M₂ (black polyethylene mulch) recorded the maximum plant height (2.99 m), followed by M₁ (without mulch) which registered 2.89 m (Fig. 1). Better growth in terms of plant height was observed in mulched plots due to changes in soil and air temperature near the cover, soil water balance and nutrient availability when compared with that of the unmulched trees (Gary Gordon *et al.*, 2010). Less soil compaction and hence improved aeration under mulched soil have also contributed to increased plant growth (Liu *et al.*, 2011). However effect of black polyethylene mulch on plant height may be attributed to increased soil temperature, which changed plant microclimate as a result, faster

plant growth was observed. This is in conformity with the findings of QumerIqbal *et al.*, (2009).

Pruning (P)

Among the different months of pruning compared, the plant height at 120 days after pruning showed the significant difference. The P₂ (August pruning) recorded the maximum height (3.02 m), which was on par with P₁(July pruning) with a value of 2.99 m. While P₃ (September pruning) registered the lowest plant height of 2.81 m. Considering the canopy management practices, better growth in terms of plant height in July pruning might be due to the conducive climatic conditions. Similar result was also reported by Kalicharan (2012) in annual moringa. The enhanced plant height might also be due to efficient metabolism and effective source sink relationship. Pruning increased light penetration in to the tree canopy, which might have increased photosynthesis resulting in higher plant height. These observations are in agreement with the findings of Mehta *et al.*, (2010) in tomato

Chemical spray (S)

The chemical spray showed the significant difference for plant height at 120 days after pruning during experimentation. The maximum plant height (3.34 m) was observed in S₁ (water spray), followed by S₃ (mepiquat chloride 50 ppm spray) with the value of 2.85 m. The least plant height was recorded (2.63 m) in S₂ (uniconazole 50ppm spray). Uniconazole treatment recorded a reduced height of 0.71 m compared to water spray. As a consequence, uniconazole 50 ppm spray resulted in shorter trees. Growth retardants shorten the growth by reducing internodal length and blocking the oxidation of kaurene to kaurenoic acid in gibberellin biosynthesis (Monica Meijon *et al.*, 2009). Growth

retardation by uniconazole was achieved by the inhibition of GA synthesis. The positive effect of uniconazole noticed in the present study is in accordance with the findings of Shanmugam *et al.*, (2012).

Mulching and pruning (M x P)

The interaction effect between mulching and pruning showed highly significant influence on plant height at 120 days after pruning. M₂P₂ (black polyethylene mulch and August pruning) recorded the maximum plant height (3.11 m), which was on par with M₂P₁ (black polythene mulch and July pruning) with a value of 3.09 m. It was followed by M₁P₂ (without mulch and August pruning) which recorded 2.94 m. The least plant height (2.79 m) was registered in M₁P₃ (without mulch and September pruning).

Pruning and chemical spray (P x S)

Significant difference was noticed on plant height under the interaction of different months of pruning and chemical spray employed in the present investigation. The maximum plant height (3.55 m) was in P₁S₁ (July pruning and water spray), which was on par with P₂S₁ (August pruning and water spray). It was followed by P₃S₁ (September pruning and water spray), which recorded 2.95 m. The lowest value (2.55m) was recorded in P₁S₂ (July pruning and uniconazole 50 ppm spray).

Mulching and chemical spray (M x S)

The combined effect of mulching and chemical spray on plant height showed significant difference. The results indicated that M₂S₁ (black polyethylene mulch and water spray) recorded the maximum plant height (3.62 m). It was followed M₁S₁ (without mulch and water spray) with a value of 3.06 m. The least plant height (2.60 m) was

showed in M₂S₂ (black polyethylene mulch and uniconazole 50 ppm spray), which was on par with M₁S₂ (without mulch and uniconazole 50ppm spray).

Mulching, pruning and chemical spray (M x P x S)

The combined effect of mulching, pruning and chemical spray indicated the significant influence on plant height at 120 days after pruning. Among the three different combinations studied, the combination M₂P₁S₁ (black polyethylene mulch + July pruning + water spray) registered the greatest plant height (3.96 m), which was on par with M₂P₂S₁ (black polyethylene mulch + August pruning + water spray).

It was followed (3.17 m) by M₁P₁S₁ (without mulch + July pruning + water spray) which was on par with M₁P₂S₁ (without mulch + August pruning + water spray) The least plant height (2.53 m) was recorded in M₂P₁S₂ (black polyethylene mulch + July pruning + uniconazole 50 ppm spray), which was on par with M₂P₂S₂ (black polyethylene mulch + August pruning + uniconazole 50 ppm spray) and with M₁P₁S₂ (without mulch + July pruning + uniconazole 50 ppm spray). However, the lowest tree height was registered by the chemical spray. Irrespective of the mulch and pruning treatment, uniconazole recorded a reduced height of 1.43 m.

Number of primary branches per tree

The number of primary branches per tree was significantly influenced by the mulching, pruning and growth retardant application (Table 2).

Mulching (M)

The number of primary branches / tree exhibited significant difference with regard to

mulching. Among the mulching treatments studied, M₂ (black polyethylene mulch) recorded the highest number of primary branches / tree (6.27), followed by M₁ (without mulch) which recorded 3.90 number of primary branches. Similarly branching was maximized in black polyethylene mulched trees followed by unmulched plants.

Prolific branching generally facilitates better light penetration and augmentation of assimilatory apparatus *i.e.*, leaf area, which in turn, enhanced higher photosynthetic activity. Hence for crops like moringa, branching could be encouraged with appropriate height. Profuse branching in moringa resulted in higher yields.

The superior performance exhibited by the black polyethylene mulch treatment on number of primary branches might be due to FR: R ratio which plays a major role in assimilates partitioning (Vijayakumar, 2001). The ratio acts through the phytochrome system to regulate branching and photosynthate partitioning among branches and roots. This is in conformity with the findings of Ashrafuzzaman *et al.*, (2011) in chilli.

Pruning (P)

Among the months of pruning compared, there was significant difference on the number of primary branches per tree. The P₁ (July pruning) recorded the highest number of primary branches per tree (5.90) which was followed by P₂ (August) with 4.86 number of primary branches, while P₃ (September) registered the lowest number of primary branches per tree (4.50).

Among the months of pruning, July pruning recorded more number of branches than other pruning. This could be attributed to the suppression of apical dominance, thereby

diverting the polar transport of auxins towards the basal nodes. Pruning breaks apical dominance when apex bud removed or headed back.

This practice makes plant more branched and dense which later on increased the fruit number per plant. This is in conformity with the findings of Kalicharan (2012) in annual moringa.

Chemicals (S)

Significant difference was noticed on number of primary branches per tree. Among the chemicals tried, the plants sprayed with uniconazole 50ppm (S₂) produced more

number of primary branches (5.31), which was followed by S₁ (water spray) (5.01). The least number of primary branches were observed under the plants sprayed with 50 ppm mepiquat chloride (S₃) (4.93). With regard to number of branches, significant differences were manifested among the growth retardant treatments.

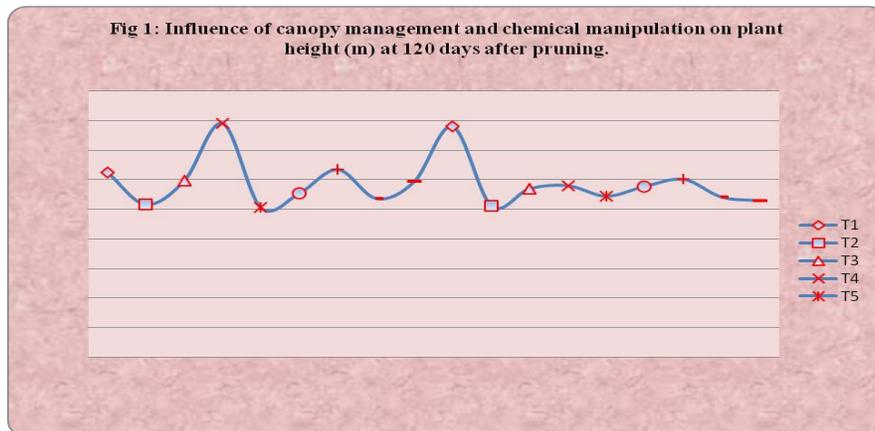
Uniconazole 50 ppm spray induced more number of branches. Uniconazole is a plant growth retardant that could reduce plant stem elongation and increase lateral growth. Increased number of branches due to uniconazole was also reported by Iyyakkannu Sivanesan *et al.*, (2011) in tomato.

Table.1 Influence of canopy management and chemical manipulation on plant height (m) at 120 days after pruning in annual moringa (*Moringa oleifera* Lam.) cv.PKM 1

Treatments	S ₁	S ₂	S ₃	Mean
M ₁	3.06	2.66	2.95	2.89
M ₂	3.62	2.60	2.76	2.99
Mean	3.34	2.63	2.85	2.94
P ₁	3.55	2.56	2.88	2.99
P ₂	3.54	2.62	2.91	3.02
P ₃	2.95	2.71	2.77	2.81
Mean	3.34	2.63	2.85	2.94
M ₁ P ₁	3.13	2.58	2.99	2.90
M ₁ P ₂	3.17	2.68	2.97	2.94
M ₁ P ₃	2.90	2.72	2.89	2.83
M ₂ P ₁	3.96	2.53	2.77	3.09
M ₂ P ₂	3.90	2.56	2.85	3.11
M ₂ P ₃	3.01	2.71	2.65	2.79
Mean	3.34	2.63	2.85	2.94
Source	SEd		CD (0.05)	
M	0.02065		0.04356	
P	0.02529		0.05335	
S	0.02529		0.05335	
MP	0.03576		0.07545	
PS	0.04380		0.09241	
MS	0.03576		0.07545	
MPS	0.06194		0.13069	

Table.2 Influence of canopy management and chemical manipulation on number of primary branches per tree in annual moringa (*Moringa oleifera* Lam.) cv.PKM 1

Treatments	S ₁	S ₂	S ₃	Mean
M ₁	4.20	3.83	3.66	3.90
M ₂	5.83	6.80	6.20	6.27
Mean	5.01	5.31	4.93	5.09
P ₁	5.65	6.35	5.70	5.90
P ₂	4.82	5.05	4.72	4.86
P ₃	4.57	4.55	4.37	4.50
Mean	5.01	5.31	4.93	5.09
M ₁ P ₁	4.80	4.40	4.15	4.45
M ₁ P ₂	4.05	3.70	3.50	3.75
M ₁ P ₃	3.75	3.40	3.35	3.50
M ₂ P ₁	6.50	8.30	7.25	7.35
M ₂ P ₂	5.60	6.40	5.95	5.98
M ₂ P ₃	5.40	5.70	5.40	5.50
Mean	5.01	5.31	4.93	5.09
Source	SEd		CD (0.05)	
M	0.08205		0.17311	
P	0.10049		0.21202	
S	0.10049		0.21202	
MP	0.14211		0.29984	
PS	0.17405		0.36723	
MS	0.14211		0.29984	
MPS	0.24615		0.51934	



Mulching and pruning (M x P)

The interaction effect between the mulching and pruning showed highly significant influence on number of primary branches per tree. M₂P₁

(black polyethylene mulch and July pruning) recorded the highest number of primary branches (7.35) per tree. It was followed by M₂P₂ (black polyethylene mulch and August pruning) which recorded 5.98 numbers of

primary branches per tree. The lowest number of primary branches (3.50) was registered in M₁P₃ (without mulch and September pruning). The interaction effects of pruning and growth retardants were not significant.

Mulching and chemicals (M x S)

Significant difference was noticed on number of primary branches per tree under the interaction of mulching and chemicals employed in the present study. The highest number of primary branches per tree (6.80) was recorded in M₂S₂ (black polyethylene mulch + uniconazole 50 ppm) followed by M₂S₃ (black polyethylene mulch + mepiquat chloride 50 ppm) which recorded 6.20. The lowest number (3.66) was observed in M₁S₃ (without mulch + mepiquat chloride 50 ppm). The combined effects of mulching, pruning and chemical spray were not significant.

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How to cite this article:

Sharmila Bharathi, C., L. Pugalendhi and Mohan, B. 2019. Effect of Canopy Management and Chemical Manipulation on Morphological Attributes of Off Season Production in Annual Moringa cv. PKM1. *Int.J.Curr.Microbiol.App.Sci*. 8(02): 2642-2648.
doi: <https://doi.org/10.20546/ijcmas.2019.802.309>