



# Effect of Date of Planting and Plant Geometry on Growth and Yield Characters of Kalmegh cv. CIM Megha

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## Authors' contributions

*This work was carried out in collaboration between all authors. All authors read and approved the final manuscript.*

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## ABSTRACT

The experiment was laid out in Factorial Randomized Block design assigning time of planting (Factor A), planting geometry (Factor B) with four replications to assess the effect of date of planting and planting geometry on growth and yield of Kalmegh cv. CIM Megha. The experiment was conducted at Experimental farm, Nalanda College of Horticulture, Noorsarai, Nalanda (Bihar Agricultural University, Sabour) in the year 2013-14 and 2014-15. Factor A consisted of three time of planting viz., 15<sup>th</sup> May, 01<sup>st</sup> June and 15<sup>th</sup> June and factor B consisted of two levels of spacing S<sub>1</sub> (30 x15 cm) and S<sub>2</sub> (30 x20 cm). Pooled data on different growth and yield characters revealed 15<sup>th</sup> June as best time of planting of Kalmegh and proclaimed highest values for plant height (75.46 cm), Plant girth (7.69 mm), no. of secondary branches, no. of leaves per plant and total dry matter yield (31.75 q/ha) . on the other hand spacing level of S<sub>2</sub> (30x20 cm) also recorded highest values for plant height (68.75 cm), plant girth (7.75 mm), no. of secondary branched/plant, no. of

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leaves/plant and total dry matter yield (27.38 q/ha). The treatment combination of 15<sup>th</sup> June as time of planting and plant spacing of 30 x20 cm found best for planting of Kalmegh in the growing conditions of the Nalanda. It was followed by planting time 15<sup>th</sup> June and plant spacing of 30x 15 cm for higher growth and yield of Kalmegh.

**Keywords:** Growth; Kalmegh; planting time; plant spacing and yield.

## 1. INTRODUCTION

According to the statement given by World Health Organization (WHO), the goal of "Health for All" cannot be achieved without herbal medicines. According to the National Bureau of Plant Genetic Resources (NBPGR), the World Health Organization (WHO) has listed more than 21,000 plant species used around the world for medicinal purposes. Among the different medicinal, Kalmegh (*Andrographis paniculata*) belonging to the family Acantheceae, is an annual herb is used for various health benefits. The Kalmegh, is probably native to India and it is distributed throughout Thailand, Peninsular Malaysia to Indonesia and in India it is found in the state of Madhya Pradesh, Chhattisgarh, Odisha, Maharashtra, Assam, Bihar, West Bengal, Uttar Pradesh, Tamil Nadu and Kerala. Primary bio-active chemical constituent of the plant is andrographolide. Chen and Liang [1]. It is hepato-protective, immune-modulator, anti-inflammatory, anti-malarial, anti-diarrheal, with beneficial effect on respiratory and cardiovascular systems. Jarukamjorn and Nemoto [2]. Growth of any plant depends on accurate planting time and accurate plant population per unit area. In this regard, Ulemale et al. [3] recorded that row spacing of 60 cm gave the highest plant (3.18%) and seed (5.80%) N contents, plant (0.59%) and seed (0.96%) phosphate contents, and dry matter accumulation (77.39 g per plant). A row spacing of 30 cm gave the highest plant (248.95 kg/ha) and seed (45.43 kg/ha) N uptake, and plant (44.45kg/ha) and seed (8.00 kg/ha) phosphate uptake. Khanda et al. [4] reported that row spacing of 60 cm produced significantly taller plants, higher number of branches, leaves and pods per plant, and seeds per pod compared to other row spacings of 45 and 30 cm in rice bean (*Vigna umbellata*). Semwal et al. [5] studied on Influence of planting geometries and weed control practices on growth and herbage yield of Kalmegh (*Andrographis paniculata* Nees.) indicated that kalmegh growth related parameters like number of branches, plant spread and leaf area index were significantly influenced by the wider planting geometry over

that of closure during both the years. However, plant height, dry matter accumulation by crop/m<sup>2</sup> and dry hectare herbage yield/ha were significantly influenced under the closing planting geometry as compared to wider during both the years. In the fact of above data and findings, the present investigation was planned to be carried out to asses time of planting and planting geometry on growth and yield of Kalmegh.

## 2. MATERIALS AND METHODS

The present investigation was carried out at Experimental farm, Nalanda College of Horticulture, Noorsarai, Nalanda a unit of Bihar Agricultural University, Sabour in Factorial Randomized Block Design with three time of planting viz, 15<sup>th</sup> May., 01<sup>st</sup> June, 15<sup>th</sup> June designated as factor A and two levels of spacing S<sub>1</sub> (30x15 cm) and S<sub>2</sub> (30 x20 cm) designated as factor B with four replications in the year 2013-14 and 2014-15. The factorial Randomised Block design was used because of two inter depended factors studied simultaneously. Data was recorded in tabulate format as per applicable for Statistical analysis for Factorial Randomized block design. The experimental soils are newly formed alluvial soil with pH 7.14 rich in organic matter. Seeds of Kalmegh cv. CIM Megha was collected from CIMAP, Lucknow. Seed was sown in nursery beds of 3x1 mtr. size. Seeds were sown in the nursery bed one month before time of planting in each case. Before sowing the seeds were treated with Thiam@ 2gm/kg of seeds. All the standard recommended cultivation practices were followed for cultivation of the crop including fertilization with 80 kg Nitrogen, 80 kg Phosphorus and 50 kg of Potash. ½ nitrogen and full P and K were applied at the time of final field preparation. Remaining nitrogen was applied by broadcasting at 40 days intervals. All the growth parameters viz. Plant Height, number of secondary branches, plant girth, number of leaves per plant, total dry herb yield were recorded at maturity. The obtained data was analyzed for Factorial Randomized Block Design and result was interpreted for effects and interactions as per method suggested by Panse and Sukhatme [6].

### 3. RESULTS AND DISCUSSION

The data presented in the Table 1 showed significant (at 5% level of probability) effect of date of planting and spacing on growth and yield attributes of Kalmegh cv. CIM Megha. Planting of seedlings on 15<sup>th</sup> June recorded the highest Plant height (75.46 cm) followed by planting on 01<sup>st</sup> June (65.47 cm) and lowest plant height was obtained with planting of seedlings on 15<sup>th</sup> May (53.92 cm). Other growth characters like Plant girth (7.69 mm), no. of secondary branches (21.80), no. of leaves per plant (88.25), plant dry weight (21.39 gm) and total dry herb yield (31.75 q/ha) were noted highest with 15<sup>th</sup> June as date of planting of seedlings. Among the different spacings, planting of seedlings at 30x20 cm gave highest values for plant height (68.75 cm), plant girth (7.75 mm), no. of secondary branches (20.35), no. of leaves/plant (78.84), plant dry weight (19.26 gm) and total dry matter yield (27.38 q/ha) followed by S<sub>1</sub> i.e. planting of seedlings at the spacing of 30 x15 cm.

Data on the different interaction for total dry matter yield of Kalmegh cv. CIM Megha has been presented in Table 2, the treatment combination of 15<sup>th</sup> June planting date and spacing of 30x20 cm gave highest dry herb yield (35.21 q/ha) followed by planting on 1<sup>st</sup> June and spacing of 30x15cm (28.30 q/ha). However, least total dry herb yield was obtained with planting of seedlings on 15<sup>th</sup> of May in both the levels of

spacing S<sub>1</sub> (30x15 cm) and S<sub>2</sub> (30x20cm) i.e. 20.42 q/ha and 21.72 q/ha, respectively. The highest values of growth characters on 15<sup>th</sup> June as planting date and wider spacing i.e. 30 x 20 cm (S<sub>2</sub>) might be attributed to better establishment of seedlings of kalmegh in the field, congenial temperature and vast open area for growth of the plant. Similarly in agreement with the findings of the present investigation, Singh and Singh [7] at Muzzaffarnagar (U.P.) concluded that spacing of 15 x 15 cm resulted gave highest dry herb yield (0.75 t/ha) which was followed by 30 x 15 cm spacing (0.50 t/ha) while the plant spacing at 30 x 30 cm recorded the lowest yield (0.33 t/ha) in Kalmegh. Kumar and Sood [8] also mentioned 15<sup>th</sup> Feb. as best time for planting of suckers of *Mentha piperita* L. under growing conditions of Himanchal Pradesh for growth and yield attributes at the plant spacing of 30x45 cm. on the other hand, Sharma [9] while studying on Effect of dates of transplanting on the growth and oil yield of *Mentha arvensis* L. under growing conditions of Lucknow mentioned 15<sup>th</sup> March as best time for planting of suckers with respect to plant height, herb and oil yield. Kumar and Kumar [10], while working on Spatial and harvesting influence on growth, yield, quality, and economic potential of Kalmegh (*Andrographis paniculata* Wall Ex. Nees) mentioned the maximum values for dry herbage biomass yield (5.14 t ha<sup>-1</sup>), net returns (760.00 EUR ha<sup>-1</sup>), B:C ratio (2.59), andrographolide content (2.63%) and total yield

**Table 1. Effect of date of planting and plant geometry on growth and yield characters of Kalmegh cv. CIM Megha (Pooled data for the year 2013-14 and 2014-15)**

Treatments	Plant Height (cm)	Plant Girth (mm)	No. of leaves/ plant	No. Secondary branches/ plant	No. of pods /plant	No. of seed/ pod	Plant dry weight (g)	Total dry matter yield (q/ha)
<b>Date of planting</b>								
15 <sup>th</sup> May	53.92	5.33	51.87	13.10	37.27	7.25	13.13	21.07
01 <sup>st</sup> June	65.47	6.45	65.82	15.27	50.18	8.37	14.83	23.68
15 <sup>th</sup> June	75.46	7.69	88.25	21.80	61.93	9.98	21.39	31.75
<b>C. D. at 5%</b>	<b>5.20</b>	<b>0.42</b>	<b>4.55</b>	<b>1.30</b>	<b>4.16</b>	<b>0.83</b>	<b>1.41</b>	<b>1.96</b>
<b>SEm±</b>	<b>1.71</b>	<b>0.13</b>	<b>1.49</b>	<b>0.42</b>	<b>1.37</b>	<b>0.27</b>	<b>0.47</b>	<b>0.64</b>
<b>Spacings</b>								
30 x 15 cm	61.15	5.23	58.45	13.10	44.82	7.75	13.65	23.63
30 x 20 cm	68.75	7.75	78.84	20.35	54.76	9.32	19.26	27.38
<b>C. D. at 5%</b>	<b>4.24</b>	<b>0.34</b>	<b>3.72</b>	<b>1.06</b>	<b>3.40</b>	<b>0.68</b>	<b>1.16</b>	<b>1.59</b>
<b>SEm±</b>	<b>1.39</b>	<b>0.11</b>	<b>1.22</b>	<b>0.35</b>	<b>1.12</b>	<b>0.22</b>	<b>0.38</b>	<b>0.53</b>

**Table 2. Interaction effect of date of planting and plating geometry on total dry matter yield of Kalmegh cv. CIM Megha**

Treatment	Total dry matter yield (q/ha)		Mean
	S1 (30 x 15 cm)	S2 (30 x 20 cm)	
15 <sup>th</sup> May	20.42	21.72	<b>21.07</b>
01 <sup>st</sup> June	22.17	25.20	<b>23.68</b>
15 <sup>th</sup> June	28.30	35.21	<b>31.76</b>
<b>Mean</b>	<b>23.63</b>	<b>27.38</b>	

**ANOVA for interaction**

Factors	C.D. at 5%	SE(d)	SE(m)
Factor (A) Date of Planting	1.956	0.909	0.643
Factor (B) Plant spacings	1.597	0.742	0.525
Factor (A X B) Interaction	2.766	1.286	0.909

(135.00 kg ha<sup>-1</sup>) were detected 135 days after planting with an optimum planting distance of 30x15 cm. With respect to plant geometry, Salim et al. [11] studied on Effect of Spacing and Seasonal Variation on Growth Parameters, Yield and Oil Content of Mint Plants and mentioned that wider spacing (30 and 40 cm) promoted branching without changes in oil content. Summer season proved to be the best for growth, herb production and oil yield of mint plants followed by autumn and winter. Sharma and Sharma [12] also proclaimed highest herb yield in 40x35 cm spacing with the mean oil yield percent ranged from 0.61-0.63% with or without irrigation.

**4. CONCLUSION**

The experiment was laid out in Factorial Randomized Block design assigning time of planting (Factor A), planting geometry (Factor B) with four replications to assess the effect of date of planting and planting geometry on growth and yield of Kalmegh cv. CIM Megha. Stastical analysis showed significant effect of time of planting and planting geometry on various growth and yield attributes. On the basis of interpretation of the results of findings, it can be concluded that the treatment combination of 15<sup>th</sup> June as time of planting and plant spacing of 30 x20 cm found best for planting of Kalmegh in the growing conditions of the Nalanda. It was followed by planting time 15<sup>th</sup> June and plant spacing of 30x 15 cm for higher growth and yield of Kalmegh.

**COMPETING INTERESTS**

Authors have declared that no competing interests exist.

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