E-ISSN: 2618-0618
P-ISSN: 2618-060X

NAAS Rating (2025): 5.20
www.agronomyjournals.com
2025; 8(9): 982-985
Received: 07-06-2025
Accepted: 09-07-2025

Aatish Kumar Sharma
Division of Silviculture and Agroforestry, Sher-e-Kashmir University of Agricultural Sciences and Technology, Jammu, Jammu and Kashmir, India

Lalit Mohan Gupta
Division of Forest Product and Utilization, Sher-e-Kashmir University of Agricultural Sciences and Technology, Jammu, Jammu and Kashmir, India

Meenakshi Gupta
Division of Silviculture and Agroforestry, Sher-e-Kashmir University of Agricultural Sciences and Technology, Jammu, Jammu and Kashmir, India

Sarabdeep Kour
Division of Soil Science and Agricultural Chemistry, Sher-e-Kashmir University of Agricultural Sciences and Technology, Jammu, Jammu and Kashmir, India

Akshay Kumar
Division of Silviculture and Agroforestry, Sher-e-Kashmir University of Agricultural Sciences and Technology, Jammu, Jammu and Kashmir, India

Corresponding Author:
Aatish Kumar Sharma
Division of Silviculture and Agroforestry, Sher-e-Kashmir University of Agricultural Sciences and Technology, Jammu, Jammu and Kashmir, India

Evaluation of growth and yield traits among Kalmegh (*Andrographis paniculata*) germplasm under Jammu subtropics

Aatish Kumar Sharma, Lalit Mohan Gupta, Meenakshi Gupta, Sarabdeep Kour and Akshay Kumar

DOI: https://www.doi.org/10.33545/2618060X.2025.v8.i9n.3887

Abstract
Kalmegh (*Andrographis paniculata* Nees) is an important medicinal crop widely used in allopathic and traditional system of medicine in India. The present study evaluated fourteen accessions of kalmegh (*Andrographis paniculata*) under the subtropical conditions of Jammu, India, aiming to identify genotypes with superior accessions of Kalmegh. The experiment was conducted at the Agroforestry Experimental Farm, Sher-e-Kashmir University of Agricultural Sciences and Technology, Jammu, using a randomized block design. Substantial variability was observed across accessions for traits including plant height, number of branches, plant spread, number of leaves, and herbage yield., Accession IC-622552 achieved the highest dry herbage yield per hectare (31.41 q ha^{-1}), closely followed by IC-622554 (29.07 q ha^{-1}). Both accessions also excelled in key growth parameters, including plant height, plant spread, number of branches, and fresh herbage weight per plant. The findings underscore the potential of IC-622552 and IC-622554 as promising candidates for enhancing medicinal plant production and supporting agricultural diversification in Jammu's subtropical climates.

Keywords: *Andrographis paniculata*, accessions, herbage yield, variability

1. Introduction
The Union Territory of Jammu and Kashmir is rich in flora and fauna and storehouse of many herbal species. The Jammu province is distinguished by its extensive variety of medicinal & aromatic plants, attributed to its diverse agroclimatic conditions ranging from subtropical to intermediate-temperate and cold arid zones. The region's agriculture is primarily characterized by smallholder farmers who face financial challenges, particularly in rainfed or Kandi areas. The geographical area of Jammu province is 26,293 sq. km, of which about 9.64% (2534.64 sq. km) is Kandi, including parts of Jammu, Samba, Kathua, Reasi and Udhampur districts. Medicinal and aromatic plants with low water and less fertile soil requirement can be boon for framers in rainfed/kandi areas. *Andrographis paniculata* is one among the species (*Aloe barbandesis*, *Withania somnifera*, *Cassia fistula*, *Tinospora cordifolia Amaltas*, *Solanum nigrum* etc.) which have low water requirement, can be grown on marginal lands, and thus is suitable for diversification in dryland farming.
It is an herbaceous species belonging to family Acanthaceae and commonly known as Kalmegh, 'King of bitters', 'Green Chirayta', Kirayat, Bhui, Nimba, Nelaberu, Nila Vembu etc. (Maheshwari *et al*., 2004) [10]. This species is predominantly cultivated across Southern and Southeast Asia and is indigenous to India and Sri Lanka. Within India, its primary cultivation occurs in states such as Assam, Bihar, Kerala, and Karnataka. It holds significant value in both traditional medicinal systems, including Ayurveda and Unani, as well as in modern allopathic medicine. The therapeutic potential of this plant is primarily attributed to the presence of diterpene lactone called andrographolide in above ground herbage which is bitter in nature and another important constituent which is non-bitter compound called neo-andrographolide. These compounds possess antipyretic, hepatoprotective, hypoglycaemic, choleretic, antidiarrheal, immunostimulant, anti-inflammatory, antimalarial, antihypertensive, properties besides inhibitor

against HIV (Raina *et al*., 2013) [12]. Panchang, referring to the stem, leaves, flowers, seeds, and roots of the plant, holds a significant place in Indian traditional medicine. It is utilized for its antioxidant, digestive, tonic, fever-reducing, and antifertility properties. Among medicinal plants, Kalmegh stands out as a key component in numerous polyherbal formulations playing a central role in over half of the herbal remedies available in India, particularly those used for treating liver dis. According to Balachandran and Govindarajan (2005) [1], the herb is officially recognized in the Indian Pharmacopoeia and is listed as a primary ingredient in at least 26 Ayurvedic formulations, many of which are specifically used for the treatment of liver-related disorders. In recent years, kalmegh has drawn attention for its possible utility in mitigating health concerns associated with the COVID-19 pandemic. Research suggests that kalmegh extracts may improve immune responses and demonstrate antiviral properties, providing them potential options for aiding in the treatment of COVID-19 (Verma *et al*., 2021; Kumar *et al*., 2024) [15, 7]. Kalmegh's effectiveness in enhancing immunity is due to its immunomodulatory characteristics, which may assist in relieving the effects of infections, particularly those induced by coronaviruses (Kumar *et al*., 2024) [7]. Research indicates that chemicals extracted from kalmegh could inhibit viral growth and reduce symptoms associated with infections (Verma *et al*., 2021; Satruhan & Patel, 2023) [15, 13].

Kalmegh is recognized as a significant crop in rainfed agricultural systems due to its resilience in low-water conditions and adaptability to various climatic environments. It is particularly valued in sustainable agriculture for its medicinal properties, providing farmers with a reliable source of income while promoting soil biodiversity and health Yodphet *et al*. (2024) [16]. In the Kandi region of Jammu province, kalmegh, a dryland crop, can be a preferable choice for crop diversification. The study aimed to identify the promising genotypes among the existing population to increase its production *vis-a-vis* profitability to the grower.

2. Materials and Methods

1) Experimental site

The present study was conducted at the Experimental Farm of the Division of Agroforestry, Sher-e-Kashmir University of Agricultural Sciences and Technology, located in Chatha, Jammu, within the Union Territory of Jammu and Kashmir, India (180009). The site lies in the subtropical zone of the Jammu region, situated at an altitude of 332 meters above mean sea level, with geographic coordinates of 32°40′ N latitude and 74°58′ E longitude.

2) Experimental material and design

The experiment was laid out in a Randomized Block Design (RBD) consisting of 14 accessions, each replicated three times. The experimental material included seeds of 14 distinct accessions, which were obtained from the National Bureau of Plant Genetic Resources (NBPGR), New Delhi, in April 2019.

3) Field preparation

The field was finely prepared, creating sunken beds measuring 1.0 m x 1.5 m. The seedlings were subsequently transplanted, maintaining a spacing of 30 cm by 45 cm, with each plot accommodating nine plants. For nursery beds, FYM at 20 kg m^{-2} was mixed as a basal dose with the soil. In the main field, FYM at 12.5 t ha^{-1} was applied as a basal treatment. Furthermore, chemical fertilizers containing nitrogen, phosphorus, and potassium in a ratio of 45:25:25 were applied. All cultural and plant protection practices were diligently followed from sowing until the harvesting of kalmegh

3. Results

Among the 14 accessions, wide variability was observed among all the traits (Table 1). IC-622552 recorded the highest significant value (64.76cm) for plant height which was followed by the accessions IC-622554 (60.27cm) and IC-622545 (59.47cm). Lowest plant height was recorded in IC-622544 (40.87cm). The higher values of number of branches per plant were also reported in the accession IC-622552 (17.26) followed by IC-622554 (16.74), while the minimum of branches was recorded in IC-622544 (8.99). The maximum number of leaves per plant was recorded in IC-622552 (445.49) followed by IC-622554 (424.34) and IC-622545 (414.56). However, minimum number of leaves per plant was registered in IC-622544 (262.84. Accession IC-622552 recorded the highest value (47.27 cm) for plant spread which was followed by IC-622554 (44.48cm). Minimum plant spread was observed in accession IC-622544 (27.54cm).

Table 1: Mean performance of growth parameters in different accessions of kalmegh

Accessions	Plant height (cm)	Number of branches plant-1	Plant spread (cm)	Number of leaves plant-1
IC-622544	40.87	8.99	27.54	262.84
IC-622545	59.47	15.96	43.68	414.56
IC-622546	48.45	10.04	32.85	284.07
IC-622547	51.33	11.01	35.08	299.49
IC-622548	57.23	13.74	41.68	354.85
IC-622549	58.29	14.21	42.95	374.45
IC-622550	53.33	11.77	37.12	308.48
IC-622551	55.42	12.97	38.91	329.27
IC-622552	64.76	17.26	47.27	445.49
IC-622553	56.3	13.18	40.93	339.74
IC-622554	60.27	16.74	44.48	424.34
IC-622555	56.33	13.21	40.42	342.59
IC-623172	43.53	9.85	29.44	279.09
IC-623182	54.33	11.86	37.75	318.18
CD0.05	2.73	1.88	2.32	19.64

Accession IC-622552 recorded the highest fresh herbage weight per plant (87.43g) which was followed by IC-622554 (77.64g), while the minimum fresh herbage yield was obtained in accession IC-622544 (45.04g). A perusal of data revealed that maximum fresh root weight per plant recorded in IC-622552 (8.54g) was followed by IC-622554 (7.59g) while the minimum was registered in IC-622544 (3.97g). The higher values of dry root weight per plant were recorded in IC-622552 (4.02g) while the minimum was observed in IC-622544 (1.82g). The higher values of fresh herbage weight per plant were also reported in the accession IC-622552 (87.43g) were significantly higher than other accessions, while the minimum was recorded in (8.99). The maximum number of leaves per plant was recorded in IC-622552 (445.49). Dry herbage yield per plant recorded highest in accessions IC-622552 (42.41g) and IC-622554 (39.25g) while the lowest was observed in the accession IC-622544.

Dry herbage yield per hectare in present study is in the range of 12.25-31.41 q ha-1, highest being recorded in accessions IC-622552 followed by IC-622554 while, the lowest in accessions IC-622544 (Table 2).

Table 2: Mean performance of yield parameters in different accessions of kalmegh

Accessions	Fresh root weight plant-1 (g)	Dry root weight plant-1 (g)	Fresh herbage weight plant-1 (g)	Dry herbage weight plant-1 (g)	Root- shoot ratio	Estimated dry herbage yield (q ha-1)
IC-622544	3.97	1.89	45.04	16.54	0.115	12.25
IC-622545	7.44	3.28	71.34	33.14	0.099	24.54
IC-622546	4.63	2.09	49.95	19.32	0.108	14.31
IC-622547	4.98	2.17	52.96	20.96	0.104	15.52
IC-622548	7.01	2.99	64.28	29.45	0.101	21.81
IC-622549	7.23	3.07	68.49	31.76	0.097	23.52
IC-622550	5.48	2.26	54.51	21.64	0.104	16.02
IC-622551	6.28	2.48	58.34	24.01	0.102	17.38
IC-622552	8.54	4.02	87.43	42.41	0.095	31.41
IC-622553	6.48	2.60	60.84	25.96	0.100	19.22
IC-622554	7.59	3.46	77.64	39.25	0.089	29.07
IC-622555	6.54	2.77	61.96	26.36	0.106	19.49
IC-623172	4.16	1.98	46.94	17.96	0.112	13.30
IC-623182	5.95	2.36	57.15	23.07	0.102	17.08
CD0.05	1.39	1.09	6.73	3.79	NS	2.78

Discussion

1. Among the fourteen accessions evaluated, IC-622552 recorded the highest significant value (64.76 cm) for plant height which was followed by the accessions IC- 622554 (60.27 cm) and IC-622545 (59.47 cm). Lowest plant height was recorded in IC- 622544 (40.87 cm) (Fig.1). Hemalatha and Suresh, (2012) [6] have also reported a similar range of plant height (56.54 cm- 42.96 cm) in their study on kalmegh at Horticultural College and Research Institute, Periyakulam. The higher values of number of branches per plant were also reported in the accession IC-622552 (17.26) followed by IC-622554 (16.74), while the minimum of branches was recorded in (8.99). Number of branches per plant recorded are in line with experiment conducted at NDUAT, Faizabad where the maximum of 22.50 branches per plant and the minimum of 10.40 branches were recorded in the entry AICRP-MAPB-120-122 of kalmegh (DMAPR, 2013) [4]. The maximum number of leaves per plant was recorded in IC-622552 (445.49) followed by IC-622554 (424.34) and IC-622545 (414.56). However, minimum number of leaves per plant was registered in IC-622544 (262.84). These are in conformity with the early finding of Liphan and Detpirtmongkol (2017) [9] wherein, range of 469-212 leaves per plant was recorded in different genotypes of kalmegh. Lattoo *et al.* (2008) [8] also observed a range of 216.6-419 leaves per plant in kalmegh while screening different genotypes of kalmegh.
2. Accession IC-622552 recorded the highest value (47.27 cm) for plant spread which was followed by IC-622554 (44.48 cm). Minimum plant spread was observed in accession IC-622544 (27.54 cm) (Fig.4). Semwal *et al.*, (2016) [14] also recorded a similar observation on plant spread with the range of 47.10 cm to 38.40 cm in kalmegh while conducting experiment on different planting geometry. Similar result with highest value of plant spread with 47.23 cm and minimum value 38.63 cm was registered in experiment on genotypic evaluation of kalmegh at Faizabad (DMAPR, 2017) [5]. Accession IC-622552 recorded the highest fresh herbage weight per plant (87.43 g) which was followed by IC-622554 (77.64 g), while the minimum fresh herbage yield was obtained in accession IC-622544 (45.04 g). Dry herbage yield per plant recorded highest in accessions IC-622552 (42.41 g) and IC- 622554 (39.25 g) while the lowest was observed in the accession IC-622544 (16.54 g). These result are in contradiction with the finding of Pandey and Mandal (2010) [11] who have reported lower range of fresh herbage weight per plant and dry herbage weight per plant of 64.80-58.30 g and 18.92-16.58 g, respectively. This may be due to climatic variation at two places. However, the fresh and dry herbage yield per plant recorded in the present study are in conformity with earlier reports of Lattoo *et al.*, 2008 [8]; DMAPR, 2013 [4] and Devi *et al.*, 2017 [2].
3. Dry herbage yield per hectare in present study is in the range of 12.25-31.41 q ha^{-1}, highest being recorded in accessions IC-622552 followed by IC-622554 while, the lowest in accessions IC-622544 (Fig. 5). The yield observed is within the range of 6.64- 42.55 q ha^{-1} and is in line with reports by DMAPR, (2017) [5]; Raina *et al.* (2013) [12]; Hemalatha and Suresh (2012) [6] and DMAPR, (2012) [3].

Conclusion

The comparative analysis of fourteen Kalmegh accessions under subtropical Jammu conditions provided valuable insights into their differential growth and yield performance. Dry herbage weight $plant^{-1}$, Fresh herbage weight $plant^{-1}$ and plant spread varied from 42.41-16.54 g, 87.43-45.04 g and 47.27-27.54 cm, respectively. Higher dry herbage yield per hectare (q) was observed in accession IC-622552 (31.41 q ha^{-1}) and IC-622554 (29.07 q ha^{-1}). These two accessions stand out as superior performers with strong potential for cultivation in rainfed marginal lands, offering valuable options for enhancing medicinal plant production in the region.

References

1. Balachandran P, Govindarajan R. Cancer - an ayurvedic prospective. Pharmacol Res. 2005;51(1):19-30.
2. Devi H, Dhuri H, Tirkey A, Porte SS. Genetic variability and heritability studies in *Andrographis paniculata* Wall. Ex Nees. Int J Curr Microbiol Appl Sci. 2017;6(11):1847-1855.
3. Directorate of Medicinal and Aromatic Plants Research (DMAPR). Annual report (2011-2012) - All India Coordinated Research Project on Medicinal & Aromatic Plants and Betelvine. Anand (India): ICAR-DMAPR; c2012, 100 p.
4. Directorate of Medicinal and Aromatic Plants Research

(DMAPR). Annual report (2012-2013) - All India Coordinated Research Project on Medicinal & Aromatic Plants and Betelvine. Anand (India): ICAR-DMAPR; c2013, 122 p.
5. Directorate of Medicinal and Aromatic Plants Research (DMAPR). Annual report (2016-2017) - All India Coordinated Research Project on Medicinal & Aromatic Plants and Betelvine. Anand (India): ICAR-DMAPR; c2017, 59 p.
6. Hemalatha P, Suresh J. Impact of integrated nutrients on growth and yield of kalmegh (*Andrographis paniculata* (Burm.f.) Wall. ex Nees). Int J Agric Sci. 2012;8(1):168-170.
7. Kumar R, Bhatt A, Ghalot M, Kumar R, Kumar H. The antimicrobial and antioxidant activity of different extracts of Kalmegh, *Andrographis paniculata* (Burm.f.) Nees. Int J Adv Biochem Res. 2024;8(1S):156-160.
8. Lattoo SN, Dhar RS, Khan S, Bamotra S, Bhan MK, Dhar AK, *et al*. Comparative analysis of genetic diversity using molecular and morphometric markers in *Andrographis paniculata* (Burm.f.) Nees. Genet Resour Crop Evol. 2008;55:33-43.
9. Liphan S, Detpiratmongkol S. Influence of different shading levels on growth and yield of Kalmegh (*Andrographis paniculata* Burm.f. Nees). J Agric Technol. 2017;13(1):79-89.
10. Maheshwari RC, Bhurchandi PM, Verma N. Cultivation, post-harvesting and quality assurance of medicinal plants in Uttaranchal. New Delhi: Deep Printers; c2004, p.79-86.
11. Pandey AK, Mandal AK. Variation in morphological characteristics and andrographolide content in *Andrographis paniculata* (Burm.f.) Nees of central India. Iran J Energy Environ. 2010;1(2):165-169.
12. Raina AP, Kumar A, Pareek SK, Sharma SK. Evaluation studies on Kalmegh (*Andrographis paniculata* Nees). Acta Hortic. 2013;972:117-120.
13. Satruhan S, Patel H. *Andrographis paniculata* (Burm.f.) Wall. ex Nees: A review on their active components and medicinal properties. Int J Pharmacogn Life Sci. 2023;4(2b):96.
14. Semwal MP, Pandey ST, Singh VP, Kumar A, Gautam P, Chaudhary S, *et al*. Influence of planting geometries and weed control practices on growth and herbage yield of Kalmegh (*Andrographis paniculata*). J Med Plant Stud. 2016;4(6):162-166.
15. Verma R, Misra V, Tiwari D, Bisen PS. Potential of selected Indian herbs for COVID-19. Curr Tradit Med. 2021;7(4):470-477.
16. Yodphet B, Jangpromma N, Polpinit WK, Riddech N. Interaction between rhizobacteria and *Andrographis paniculata* under water limitation. Environ Nat Resour J. 2024;22(2):1-13.