Original Research Article

STUDIES ON CHARACTER ASSOCIATION FOR GROWTH, YIELD AND QUALITY COMPONENTS IN KALMEGH(*Andrographis paniculata* Nees.)

Abstract

An experiment was conducted on kalmegh to study the response of spacing and different fertilizer combinations in relation to growth, yield and quality of kalmegh. It was noticed that, spacing of 30cm×15cm with 50% RDN + 50% Vermicompost equivalent to recommended N resulted the significant increase in the herbage growth, yield and quality. The present investigation was found the correlation for various traits in kalmegh. Andrographolide content showed the positively high association with the plant height (0.86), number of secondary braches per plant (0.76), number of primary braches per plant (0.70) and fresh herbage yield per plant (0.68).

Key words: Correlation, herbage, andrographolide content and kalmegh

Introduction:

Kalmegh (*Andrographis paniculata* Nees.) is an important medicinal plant widely distributed in India. It is known as "King of Bitter" because of its bitterness which is due to presence of diterpenoids called andrographolide.Kalmegh is used in Indian traditional medicine against various diseases such as cough, cold, fever, diabetic, piles, bronchitis and skin disorder. It also acts as antipyretic, anti-inflammatory, antioxidant, antibacterial activities immunostimulatory, hepatoprotective etc (Nyeem *et al*., 2017).Plant spacing is an important factor which influences the growth, yield and quality of the crop. It increases the production of the crop per unit area which ultimately helps in productivity(Amare and Gebremedhin, 2020). To maintain the fertility and health of the soil integrated application of nutrient plays an important role and supplies the optimum level nutrient to plant which leads to desired crop productivity with sustainable production of kalmegh (Kumar *et al*., 2004 and Manna *et al*., 2005). The extent of correlation between two independent characters which influences the dependent character

could be through the correlation concept. The deviation or nearest relation correlation coefficient helps to know the magnitude of influence of independent character on the dependent character and andrographolide content being a dependent parameter of correlation with various parameters. The present experiment was conducted to evaluate the correlation of andrographolide with plant growth, yield and quality characters of kalmegh under fertilizer application and spacing.

Materials and methods:

The experiment was conducted during *kharif* season of 2019-2020 at Horticulture Farm, Main Agricultural Research Station, College of Agriculture, University of Agricultural Sciences, Raichur, Karnataka, India. The experiment was laid out in a split plot design in 3 replication with 15 treatment combinations comprised of three levels of spacing *viz*., S_1 (30 cm x 15 cm), S_2 (30 cm x 30 cm) and S_3 (30 cm x 45 cm) as main plot with five levels of fertilizers (F) *viz*., F_1 = 100% RDF (75:75:50 NPK kg ha^{-1}), F_2 = FYM alone equivalent to recommended N, F_3 = Vermicompost alone equivalent to recommended N, F_4 = 50% RDN + 50% FYM equivalent to recommended N and F_5= 50% RDN + 50% Vermicompost equivalent to recommended N as sub plots treatments. The chemical analysis was carried out at Pesticide Residue and Food Quality Analysis Laboratory [PRFQAL], UAS, Raichur, Karnataka. Correlation coefficient were worked out as per the procedure outlined by Panse and Sukhatme (1985) to study the nature and degree of relationship between the andrographolide content of kalmegh with various growth and yield components (SPSS software was used for the analysis of statistical data).

Results and discussion:

The study revealed that, there was a strong association was noticed among herbage growth, yield and quality components. It is noticed that, andrographolide has significant and positive correlation of number of secondary branches per plant (0.80) followed by number of primary branches per plant (0.74), number of secondary branches per plant (0.80), leaf area (0.57). On the contrary, total dry matter accumulation (-0.15) exhibited the negative correlation for andrographolide content (0.86)[Table-1].

Number of primary branches per plant established the highly significant and positive correlation with number of secondary branches per plant (0.95) followed by leaf area (0.93),

number of leaves per plant (0.90), fresh herbage yield per plant (0.86). However, moderate correlation was observed with the total dry matter accumulation (0.41) [Table-1].

Number of secondary branches per plant exhibited the highly significant and positive correlated with the leaf area (0.93) followed by the number of leaves per plant (0.88), fresh herbage yield per plant (0.85), dry herbage yield per plant (0.84) while, moderate correlation with the total dry matter accumulation (0.40) [Table-1].

In relation to number of leaves per plant was significant and positively correlated with the leaf area (0.98) followed by the total dry matter accumulation (0.73), fresh leaf yield per plant (0.90), fresh herbage yield per plant (0.92), dry herbage yield per plant (0.91) and andrographolide content (0.51) [Table-1].

The leaf area was highly significant and positively correlated with the number of leaves per plant (0.98) and number of secondary branches per plant (0.93) followed by the fresh herbage yield per plant (0.96) and dry herbage yield per plant (0.94) while, moderately correlation with andrographolide content (0.65) and total dry matter accumulation (0.62) [Table-1].

The total dry matter accumulation was significant and positively correlation with the number of leaves per plant (0.73), fresh leaf yield per plant (0.61), fresh and dry herbage yield per plant (0.61 and 0.68). However, the association with andrographolide content (-0.02) was found to be negative correlation [Table-1].

Fresh herbage yield per plant established the significant and positive correlation with leaf area (0.96) followed by fresh herbage yield per plant (0.95) and number of leaves per plant (0.92) while moderately correlated with the number of secondary branches per plant (0.794) [Table-1].

Dry herbage yield per plant exhibited the highly significant and positively correlated with the Fresh herbage yield per plant (0.97) followed by leaf area (0.94) and fresh leaf yield per plant (0.93) while moderate with the total dry matter accumulation (0.68) [Table-1].

The andrographolide content was significant and positive correlation with the plant height (0.86) followed by the number of secondary braches per plant (0.76) while, negative

correlation with the total dry matter accumulation (-0.02) [Table-1]. These results are in agreemented with Chitra and Rajamianiin, 2010 and Pallavi *et al*., 2022 in glory lily, Misra *et al*., 2013 in bishop's weed Babulal *et al.*, 2021 in ashwagandha, Kandil, *et al*., 2023 basil and Dayana *et al*., 2018, Kumar *et al*., 2018 and Dharshini *et al*., 2023 in kalmegh.

Conclusion:

Correlation study measures the linear relationship of the two or more variables and their association which facilitates the improvement of quantitative as well as qualitative characters. The above correlation study, revealed that majority of the character established a significantly positively correlation with andrographolide content. However, plant height, number of primary and secondary branches per plant, number of leaves per plant, leaf area, fresh leaf yield per plant, fresh and dry herbage per plant were found to influence andrographolide content positively. The total dry matter accumulation established negative correlation with the andrographolide content.

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References:

1. Amare G and Gebremedhin H. Effect of plant spacing on yield and yield components of tomato (*Solanum lycopersicum* L.) in Shewarobit, Central Ethiopia. Scientifica, 2020;1-6.
2. Babulal D, Amit D, Padiwal NK and Raiuram C. Correlation studies in ashwagandha [*Withania somnifera* (L.) Dunal], Curr. Appl. Sci. Technol. 2021;40(20):58-64.
3. Chitra, R and Rajamiani K. Character association and path analysis in glory lily (*Gloriosa superba* L.). *Commun.* Biometry Crop Sci. 2010;5(2):78-82.
4. Dayana SN., Himabindu K., Suryanarayana MA., Umesha K., Rao VK. and Shivapriya, M. Correlation and path analysis in Kalmegh (*Andrographis paniculata* Nees.). J. Pharma. Phytochem. 2018;SP3: 504-507.
5. Dharshini MS, Geeta KA, Parmar DJ and Prajapati PJ, Study on Genetic association among yield biochemical traits in kalmegh (*Andrographis paniculata*). Environment and Ecology.,2023; 41(2A):1090-1100.
6. Kandil, AS., Mohamed, MA., El-beltagi, HS and Gaballa, HS. The correlation of in vitro antioxidant potentials with the various biochemical responses of salinized basil leaves. Notulae Botanicae Horti Agrobotanici Cluj-Napoca, 2023;*51*(2):13110.
7. Kumar J, Animesh S, Ras BS, Hiranmayee N and Diwakar PN, Evaluvation of kalmegh (*Andrographis paniculata*) germplasm for higher biochemical constituents production under agro-climatic condition of Jharkhand. 2018;SP1:561-567.
8. Kumar RA, Sridevi K, Kumar NV, Nanduri S and Rajagopa S. Anticancer and Immune stimulatory compounds from *Andrographis paniculata.* J. Etanopharma. 2004;92(2-3): 291-295.
9. Manna MC, Swarup AM, Wanjari RH, Ravankar HN, Mishra B, Saha MN, Singh YV, Sahi DK, Sarap PA. Long-term effect of fertilizers and manure application on soil organic carbon storage, soil quality and yield sustainability under sub-humid and semi-arid tropical India. Field CropS Res. 2005;93: 264 -280.
10. Misra HO, Lal RK, Gupta AK, Kumar B, Misra AN. and Sarkar S. Genetic variability, character association and path analysis for economic traits in Bishop's weed (*Ammi visnaga* (L.)). *Lam.* Ind. Crops Prod. 2013;49:593- 597.

11. Nyeem MAB, Mannan MA, Nuruzzaman M, Kamrujjaman KM. and Das SK. Indigenous king of bitter (*Andrographis paniculata*): A review. J. Med. Plants Stud. 2017;5(2):318-324.
12. Pallavi K, Vethamoni PI, Nalina L, Rajamani K, Geethanjali S and Meenakshisundaram P, Studies on genetic variability, heritability, genetic advanceand path coefficient analysis for genetic improvement in glory lily (*Gloriosa superba* L.) genotypes. J. Pharma. Phytochem 2022; 11(7): 1451-1456.
13. Panse VG and Sukhatme, PV., Statistical methods for agricultural workers IInd enlarged Ed. ICAR., New Delhi. 1985;135-136.

Table 1. Association of growth and herbage yield characters influencing the andrographolide content of kalmegh

	Plant height	Number of primary branches per plant	Number of secondary branches per plant	Number of leaves per plant	Leaf area	Total dry matter accumulation	Fresh leaf yield per plant	Fresh herbage yield per plant	Dry herbage yield per plant	Andrographolide content
Plant height	1	0.74**	0.80**	0.45	0.57*	-0.15	0.42	0.52*	0.50	0.86**
Number of primary branches per plant		1	0.95**	0.90**	0.93**	0.41	0.81**	0.86**	0.81**	0.70**
Number of secondary branches per plant			1	0.88**	0.93**	0.40	0.79**	0.85**	0.84**	0.76**
Number of leaves per plant				1	0.98**	0.73**	0.90**	0.92**	0.91**	0.51
Leaf area					1	0.62*	0.92**	0.96**	0.94**	0.65**
Total dry matter accumulation						1	0.61**	0.61*	0.68**	-0.02
Fresh leaf yield per plant							1	0.95**	0.93**	0.64**
Fresh herbage yield per plant								1	0.97**	0.68**
Dry herbage yield per plant									1	0.65**
Andrographolide content										1

**. Correlation is significant at the 0.01 level

* Correlation is significant at the 0.05 level