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Effect of different organic manures and spacing on quality and soil fertility status on Kalmegh-Panchang (*Andrographis paniculata* Wall. Ex. Nees.) under middle Gujarat conditions

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SUMMARY

Kalmegh (deshi kariatu) is a substitute of Nepali kariatu (*swita chiruta*). Kalmegh can easily grown in the Gujarat as wild. Due to short supply and poor quality of kalmegh, it is necessecery to cultivate in the field. Regular cultivation of kalmegh is started in the Gujarat during the year 2002. Ayurveda is an ancient science of life. Which has a strong philosophical basis. Ayurveda is a dynamic phenomenon that offers multifaceted approaches for healing. It comprises of knowledge about the plants that are primarily based on the past experiences and present uses in India, more as living tradition. Significantly higher andrographolide content was observed under the treatment of organic manures *i.e.* FYM 10 t/ha and Spacing *i.e.*30 x 45 cm (1.39 and 1.40%, respectively). Interaction effect of FYM @ 10 t/ha with wider spacing of 30cm x 45cm had recorded higher 1.5% andrographolide content noted higher amount of andrographolide content. Application of FYM 10 t/ha also recorded significantly higher organic carbon , available N, P and K.

Key words : Organic manures, Panchong, Aromatic plant, Spacing, Kalmegh

Kalmegh is widely used in Indian traditional system of medicine against different aliments. It is reported that this plant possesses astringent, anodyne, tonic and alexipharmic properties which are useful in curing no. of diseases, *viz.* dysentery, cholera, diabetes, influenza bronchitis, piles, hepatomegaly, skin disorder, fever and worm. Kalmegh also showen its efficiency to control HIV-AIDS. "Panchang", the five parts of the plant *i.e.*, stem, leaf, flower, seed and root are being used in the various formulations of Indian system of homeopathic as well as ayurvedic medicines. The plant has properties like bitter acrid, cooling, laxative, antipyretic, anti- inflammatory, expectorant digestive and stomachic. The major bitter constituent in the kalmegh is due to the presence of diterpene lactone called "andrographolide". Other important constituent is a non–bitter compound neo–andrographolide and its medicinal uses.

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MATERIALS AND METHODS

A field experiment was conducted during, *Kharif* season of the year 2007 at Medicinal and Aromatic Plant Project Research farm, Anand Agricultural University, Anand, Gujarat. To study the "Effect of different organic manures and spacing quality and soil fertility status of kalmegh – panchang (*Andrographis paniculata* Wall.ex.Nees) under middle Gujarat conditions". The soil of the experimental plot was loamy sand in texture having good drainage with 7.6 soil pH.

Sixteen treatment combination consisting of four levels of organic manures *viz.*, (M_0) control, (M_1) FYM @ 10 t/ha, (M_2) castor cake @ 1 t/ha and (M_3) Vermicompost @ 2 t/ha and four spacing treatments *viz.*, (S_1) 30cm x 15cm, (S_2) 30cm x 30cm, (S_3) 30cm x 45cm and (S_4) 30cm x 60cm were tested under split plot design with four replications.

RESULTS AND DISCUSSION

The results obtained from the present investigation are presented below:

Effect of organic manures:

Difference in andrographolide content was due to different organic manures found significant. Among different treatments, treatment M_1 (FYM @ 10 t/ha) recorded significantly higher andrographolidr content % in kalmegh, being at par with treatment M_0 (Control), treatment M_2 (castor cake @ 1 t/ha) and M_3 (Vermicompost @ 2 t/ha) were remained at par with each

other. Significantly lower andrographolidr content was observed under the treatment M_3(Vermicompost @ 2 t/ ha, 1.14 %).

The increase in andrographolide content might be due to delaying in the harvesting resulted in shattering of leaves , also increased fiber content in the leaves, that reduced the quality, it means that light green colour andrographolide content obtained. Quality point of view dark green colour with less fiber content consider best quality product. The results are accordance with that of Patel *et al.* (2007) and Upadhyay *et al.* (2007). The higher organic matter content in FYM might had developed dark green colour of kalmegh powder. The other reason might be that the vegetative growth for the higher production of biomass can be stimulated by the application of proper doses of nutrients through organic manures. The results are confirmed by that of Patra *et al. (*2004).

The data presented in Table 1 indicated that the difference in organic carbon after harvest of kalmegh in soil was found significant. Among different organic manure treatments, treatment M_2 (Castor cake @ 1 t/ha; 0.473) recorded significantly the highest organic carbon. Treatment M_1 and M_3 were remained at par with each other. Significantly the lowest organic carbon (0.381) observed under treatment M_0 (control).

Perusal of the data presented in Table 1 indicated that the difference in available nitrogen after harvest of kalmegh in soil was found significant. Among different organic manure treatments, treatment M_1 (FYM @ 10 t/ ha; 230.34 kg N/ha) recorded significantly the highest available N content in soil after harvest. Treatment M_2 and M_3 were remained at par with each other. Significantly the lowest available n observed (130.49 kg/ha) under treatment M_0 (control).

The difference in available P_2O_5 after harvest of kalmegh in soil was found significant. Among different organic manure treatments, treatment M_2 (Castor cake @ 1 t/ha; 164.353 kg P_2O_5/ha) was found significantly higher P_2O_5. and was remained at par with treatment M_1. Treatment M_1 and M_3 were remained at par with each other. Significantly the lowest available P_2O_5 (132.035 kg/ha) was obtained under treatment M_0 (control).

Among different organic manures treatments, treatment M_1 (FYM @ 10 t/ha; 242.506) was recorded significantly higher available potash. Treatment M_1 and M_2 were remained at par with each other. Treatments M_2, M_3 and M_0 were remained at par with each other. Significantly lower K_2O (226.081) was observed under treatment M_0 (Control)

The reason might be due to release of organic acids from FYM, make the unavailable P_2O_5 in to soluble form *i.e.* available form of P_2O_5, and ultimately increased the available P_2O_5 and potash uptake after the harvest of

Table 1 : Effect of andrographolide content (%) , organic carbon, available nitrogen, phosphorus and potash of soil after harvest of crop as influenced by different organic manures and spacing

Treatments	Andrographolide content (%)	Organic carbon (%)	Available N (kg/ha)	Available P_2O_5 (kg/ha)	Available K_2O (kg/ha)
Organic manures (M)					
(Main plot treatment)					
M_0 : Control	1.28	0.381	130.49	132.035	226.081
M_1 : FYM @ 10 t / ha	1.39	0.434	230.34	156.653	242.506
M_2 : Castor cake @ 1 t / ha	1.21	0.473	215.42	164.353	231.599
M_3 : vermicompost 2 t / ha	1.14	0.426	205.58	151.860	227.738
S.E.±	0.046	0.010	3.599	3.184	3.384
C.D. (P = 0.05)	0.147	0.033	11.51	10.186	10.828
C V %	14.57	9.51	7.37	8.42	5.84
Spacing (S)					
S_1 : 30 cm x 15 cm	1.21	0.422	196.36	149.72	228.21
S_2 : 30 cm x 30 cm	1.23	0.439	196.81	151.52	232.58
S_3 : 30 cm x 45 cm	1.40	0.425	198.61	153.61	235.73
S_4 : 30 cm x 60 cm	1.19	0.427	190.05	150.05	231.40
S.E. ±	0.026	0.008	2.238	2.335	2.787
C.D. (P = 0.05)	0.074	NS	NS	NS	NS
Interaction (M x S)					
C D (P = 0.05)	0.15	NS	NS	NS	NS
C V %	8.24	7.36	4.58	6.18	4.80

N.S.-Non significant

Table 2 : Andrographolide content (%) of kalmegh as influenced by interaction effect organic manures x spacing (M x S)

Treatments Organic manures (M)	Andrographolide content (%) Av. plant height (cm)			
	Spacing S_1 30cm x 15cm	S_2 30cm x 30cm	S_3 30cm x 45cm	S_4 30cm x 60cm
M_0 : Control	1.25	1.25	1.25	1.25
M_1 : FYM @ 10 t/ha	1.25	1.50	1.50	1.25
M_2 : Castor cake @ 1t/ha	1.25	1.25	1.25	1.00
M_3 : Vermicompost @ 2t/ha	1.00	1.25	1.25	1.00
C.D. (P = 0.05)		0.15		
C V %		8.24		

the crop. Available N also increased due to FYM, slowly and steady released of N.

The other reason might be due to solubilisation effect of plant nutrients by the addition of FYM as evidenced by increase in uptake of N, P, K.

Effect of spacing:

Different spacing exerted their significant effect on andrographolidre content in kalmegh. Among different spacing treatments, treatment S_3 (30cm x 45 cm) recorded significantly. The highest andrographolidre content 1.40 %. Treatments S_2 (30cm x 30cm), S_1 (30cm x 15 cm) and S_4 (30cm x 60cm) were remained at par with each other. Significantly lower andrographolidre content was observed under treatment S_4 (30cm x 60cm, 1.19) and it was at par with treatments S_1 (30cm x 135 cm, 1.21) and S_2 (30cm x30cm, 1.27 %), respectively. Under this treatment provide vigorous and higher vegetative growth of the plants, higher plant height, plant breadth and leaf : stem ratio, ultimately higher biomass production of kalmegh. The results are comfirm with the finding of Patra *et al.* (2004).

Organic carbon, available nitrogen, phosphorus and potash after harvest of kalmegh in soil was found non – significant due to various spacing.

Interaction effect:

Interaction effect M x S was found significant. Treatment combinations M_1S_3 (FYM @ 10 t/ha with spacing 30cm x 45cm), M_0S_3 (Control with spacing 30cm x 45cm) and M_1S_2 (FYM @ 10 t/ha with spacing 30cm x 30cm) recorded significantly higher andrographolide content . The treatment combinations M_2S_2 (Castor cake @ 1t/ha with spacing 30cm x 60cm; 1.50), M_0S_2 (Control with spacing 30cm x 30cm 1.50), M_1S_1(FYM @ 10 t/ha with spacing 30cm x 15cm, 1.250); M_2S_2 (Castor cake @ 1t/ha with spacing 30cm x 30cm), M_2S_3 (Castor cake @ 1t/ha with spacing 30cm x 45cm), M_3S_2 (Vermicompost @ 2t/ha with spacing 30cm x 30cm), M_3S_3 (Vermicompost @ 2t/ha with spacing 30cm x 45cm) were remained non-significant with each other. These might be due to that organic manures *i.e.* FYM and wider spacing increased the vegetative growth, higher biomass, leaf : stem and ultimately higher andrographolide content, and leaf also content higher 2.52% of andrographolide. The results are in the same line of that reported by Patel (2007).

Organic carbon, available N, P_2O_5 and K_2O after harvest of kalmegh, in soil was found non – significant.

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