Journal of Pharmacognosy and Phytochemistry

Available online at www.phytojournal.com

J P P Journal of Pharmacognosy and Phytochemistry

E-ISSN: 2278-4136
P-ISSN: 2349-8234
www.phytojournal.com
JPP 2021; 10(1): 2399-2402
Received: 19-11-2020
Accepted: 22-12-2020

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Performance of garden rue (*Ruta graveolens* L.) to different levels of irrigation and mulches on growth and yield in northern dry zone of Karnataka

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Abstract
Garden rue (*Ruta graveolens* L.) strong smelling rue, commonly known as 'Nagadali' belongs to family Rutaceae. A field experiment was conducted at College of Horticulture Bagalkote, University of Horticultural Sciences, Bagalkote during kharif 2019-20 with study entitled, "Performance of Garden rue (*Ruta graveolens* L.) to different levels of irrigation and mulches on growth and yield under Northern dry zone of Karnataka" was carried out to find out best irrigation levels and mulches in garden rue. In experimental plot, twelve treatment combinations with four levels of irrigation (I1:100%, I2:80%, I3:60% and I4:40% Cumulative pan evaporation) and three different types of mulches (M1: Without mulch, M2: sugarcane trash and M3: polythene mulch) were evaluated in split plot design with three replications for growth and yield parameters under field condition.
Among treatments, combination of I2M3: Irrigation 80% CPE + polythene mulch is best as it gave maximum growth parameters such as plant height (43.13 cm), number of branches per plant (22.80), plant spread (40.17 cm), soil moisture (17.50%) and yield attributes like fresh herbage yield (469.7 g/plant and 18.47 t/ha), dry herbage yield (116.8 g/plant and 4.89 t/ha) at final harvest. Significantly in case of weed density (10.67 m2), water use efficiency (13.33 kg/ha/cm3), minimum days to first flowering (92.67 days) and 50% flowering (107.00 days) at final harvest were recorded in combination of I4M3: Irrigation 40% CPE + polythene mulch. Hence I2M3:Irrigation 80% CPE + polythene mulch recorded maximum crop growth and productivity of garden rue under Northern dry zone of Karnataka.

Keywords: garden rue (Ruta graveolens L.), irrigation and mulches, growth and yield in northern dry zone of Karnataka

Introduction
Garden rue (*Ruta graveolens* L.), strong smelling, glabrous, small evergreen sub- shrub commonly known as 'Nagadali' or 'herb-of grace' belongs to family Rutaceae. It is semi-woody perennial in its growth habit grows up to a height 0.6 to 0.9 m tall. The stems become woody near the base, leaves are alternate, 7.6 to 12.7 cm long shortly petioled, and dissected pinnately into oblong or spoon shaped segments. The flowers of rue are small, 12 mm in diameter yellowish corymbs with dichasial cymes with numerous or paniculate type of clusters. Fruits or capsules are round in shape. Seeds are minute ovoid, rounded black in appearance (Parray *et al*., 2012) [7]. In garden rue flavonoids are a part of primary chemical components i.e Rutin (2-7%), and quercetin.
Ruta graveolens L. is an odoriferous herb entire plant is of medicinal importance. It is used in Ayurveda, Homoeopathy and Unani. In traditional system of medicine, garden rue used as stimulant, emmenagogue, diuretic, and abortefacient, resolven. In Ayurveda system of medicine, the plant usage is bitter, laxative. In Unani medicine, rue is used as tonic, digestive, emmenagogue, abortifacient, antiaphordisiac, increases menstrual activity. Seeds of garden rue also used as medicine, powdered seeds of this drug are abortefacient.
Water is one of the most important essential criteria for production of crops. Irrigation scheduling is one of most critical tool and important managerial activity which effects efficient utilization of water by crops. Among different irrigation system drip irrigation play a major role "Drip irrigation is a type of micro-irrigation system that has the potential to delivery water to plants root zone directly with minimum crop losses". Use of different types of soil covers or mulches like straw, leaves, husk, crop residues and black plastics have been found to beneficial to conserve soil moisture, improves fertilizers efficiency, increasing infiltration rate, moderate soil temperature and increase in yield of different medicinal plants.

The crop is hardy and performs well even under less irrigated condition. Looking in to this, to know the quantity of irrigation required with different mulches is used to assess the performance of crop. Hence in this study, the response of garden rue to the combined effect of different levels of irrigation in conjunction with mulches is evaluated. The basic concept for underlying the combined effect of irrigation with mulch is to beneficial impact on growth and yield components in garden rue during crop period.

Material and Methods

A field experiment was conducted during kharif season 2019-2020 at College of Horticulture, Bagalkote, to evaluate the effect of different levels of irrigation and mulches to prevailing conditions of Bagalkote. Seeds were collected from department of PMA, COH Bagalkote to raise seedlings. Seed rate of 300g /ha. The land was then leveled and divided into beds of required size (4.2 m × 1.8 m) provision was made for paths for easy cultural operation. After layout of the plots, the treatments were assigned randomly to different plots individually within a replication. Seedlings of rue were ready for field transplanting after 90 days of sowing with spacing of 60 x 45 cm.

Experiment laid out in split plot design with four levels of irrigation (I1:100%, I2:80%, I3:60% and I4:40% Cumulative pan evaporation) as main plot and three different types of mulches (M1: Without mulch, M2: sugarcane trash and M3: polythene mulch) as sub plot with three replications. Treatment details, I1M1(Irrigation 100% CPE + without mulch), I1M2 (Irrigation 100% CPE + sugarcane trash), I1M3 (Irrigation 100% CPE + polythene mulch), I2M1(Irrigation 80% CPE + without mulch), I2M2 (Irrigation 80% CPE + sugarcane trash), I2M3 (Irrigation 80% CPE + polythene mulch), I3M1(Irrigation 60% CPE + without mulch), I3M2 (Irrigation 60% CPE + sugarcane trash), I3M3 (Irrigation 60% CPE + polythene mulch), I4M1(Irrigation 40% CPE + without mulch), I4M2 (Irrigation 40% CPE + sugarcane trash), I4M3 (Irrigation 40% CPE + polythene mulch) were laid out in experimental plot.

The observation on the following growth and yield parameter was recorded at final harvest by randomely labeling five plants per plot in each treatment by excluding border plant. The data recorded on growth and yield parameters during the course of experimental studies were subjected to statically analysis as per the procedure obtained. For statistical analysis software used was WASP.2 (Web Agricultural Statistics Software Package). The results were comparing at 5% of probability using Fisher's test (Sundararaj *et al*., 1972).

Results and Discussion

The vegetative growth parameters differed significantly among the different treatment combinations at all the stages of crop growth (Table 1). Combined effect of Irrigation 80% CPE + polythene mulch resulted maximum plant height (43.13 cm), number of branches per plant (22.80), plant spread (40.17 cm) at harvest. Significantly lowest plant height (32.07 cm) in I4M1, number of branches (16.81) and plant spread (27.03 cm) was recorded in I4M2. This might be due to higher availability of soil moisture by providing irrigation and indirectly impact on the uptake of nutrients from soil which maintains the turgidity cells of plants, cell enlargement and respiration rate at optimum level. Addition of mulches with moist soils leads to favorable condition for crop growth which ultimately resulted in triggering the production of plant hormones namely Indole Acetic Acid (IAA) which helped in maintaining a highest vegetative growth throughout the cropping period of plant. These records are in close correspondence with the works of Kumar *et al*. (2014) [4] in stevia, Singh *et al*. (1996) [12] in geranium and Chauhan, (2013) [2] in aloe.

The data on soil moisture was recorded in I1M3 (Irrigation 100% CPE + polythene mulch) showed maximum soil moisture per cent (19.60) which was on par with I2M3 (17.50%) and lower soil moisture (6.67%) in I4M1 at harvest. Differences in soil moisture were due to the mulches with high soil moist enhance water holding capacity of soil and also act as barrier to reduce surface evaporation rate, deep percolation and thereby accelerates maximum water availability in soil with better conservation of soil moisture. These results are also in the line of Sharma *et al*. (2016) [11] in fenugreek and Palada *et al*. (2008) [6] in basil (Table 1).

Significantly data recorded in Table 2 on minimum days to first flowering (92.67 days), 50% flowering (107.00 days), weed density (10.67 m2) and water use efficiency (13.33 kg/ha/cm3), at final harvest were recorded in combination of I4M3: Irrigation 40% CPE + polythene mulch. Significantly late flowering (128.33 and 133.67 days), highest weed density (115.67 m2), and WUE (4.00 kg/ha/cm3) was recorded in I1M1. This might be due to water stress during the critical stages of growth period and influences early onset of reproductive traits with more of translocation of photosynthetes to storage organs. In poly mulch, etiolation effect reduces weed infestation, evaporation losses and inhibit emergency of weed species and with conserves soil moisture. These features are in affinity with documents of Milesi *et al*. (2001) [5] in garden rue, Bhardwaj *et al*. (2018) [1] in chilli and Ram *et al*. (1995) [8] in Bergom mint.

Particulars presenting on herbage yield characters are depicted in Table 3 showed significant results. Among all treatments, the combined interaction of Irrigation 80% CPE + polythene mulch resulted maximum yield attributes like fresh herbage yield (469.7 g/plant, 3657.6 g/net plot and 18.47 t/ha), dry herbage yield (116.8 g/plant, 969.55 g/net plot and 4.89t/ha) at final harvest. Significantly minimum fresh herbage yield (6.70 t/ha) in I4M2 and dry herbage yield was recorded in I1M1 (1.88 t/ha). Differences in herbage yield are due to profuse improvement in growth attributes might have contributed to increase in yield attributes. Availability of suitable soil moisture regime which enhanced rapid growth and development of crop using the initial reserve food material, deposited of more food material finally gave more dry herbage yield. High rate of water absorption by roots in frequently irrigated plots maintained higher yield. These findings were documented by, Harshita *et al*. (2018) [3] in coriander and Ram *et al*. (2013) [13] in geranium. These data are in confirmation with reports of Sarrou *et al*. (2016) [10] in sweet basil.

Table 1: Growth parameter and soil moisture of garden rue at final harvest as influenced by different levels of irrigation and mulches

Treatments	Mulch																			
	Plant height (cm)					Number of branches per plant					Plant spread (cm)					Soil moisture (%)				
		M1	M2	M3	Mean		M1	M2	M3	Mean		M1	M2	M3	Mean		M1	M2	M3	Mean
Irrigation levels	I1	35.23	38.86	39.78	37.88	I1	18.23	18.47	17.43	18.04	I1	33.20	35.57	36.47	35.08	I1	8.69	10.53	19.60	12.94
	I2	38.50	39.53	43.13	40.39	I2	18.23	19.23	22.80	20.09	I2	34.23	36.67	40.17	37.02	I2	8.33	9.97	17.50	11.93
	I3	37.77	39.00	36.5	37.76	I3	19.57	17.07	17.17	17.94	I3	32.53	33.00	32.53	32.69	I3	7.39	9.87	9.53	8.93
	I4	32.07	33.00	37.97	34.34	I4	16.90	16.81	18.03	17.63	I4	32.72	27.03	34.33	31.36	I4	6.67	7.20	7.54	7.14
	Mean	35.83	37.60	39.35		Mean	18.23	17.90	19.08		Mean	33.17	33.07	35.88		Mean	7.77	9.39	13.54	
		S.Em ±		C.D @ 5%		S.Em ±		C.D @ 5%			S.Em ±		C.D @ 5%			S.Em ±		C.D @ 5%		
Main plot		0.65		2.24		0.31		1.06			0.89		3.09			0.63		2.17		
Sub plot		0.56		1.68		0.29		0.88			0.57		1.71			0.68		2.05		
M x S		1.12		3.35		0.58		1.73			1.14		3.43			1.36		4.09		
CV (%)		5.16				5.00					7.88					18.35				

Main plot treatments irrigation (I): I1: 100% CPE, I2: 80% CPE, I3: 60% CPE, I4: 40% CPE
CPE: Cumulative Pan Evaporation
Sub plot treatments mulch (M): M1: Without mulch, M2: Sugarcane trash, M3: Polythene mulch

Table 2: Reproductive characters, weed density and WUE of garden rue at final harvest as influenced by different levels of irrigation and mulches

Treatments	Mulch																			
	Days for first flowering					Days for 50% flowering					Weed density (m2)					Water use efficiency (kg/ha/cm3)				
Irrigation levels		M1	M2	M3	Mean		M1	M2	M3	Mean		M1	M2	M3	Mean		M1	M2	M3	Mean
	I1	128.33	127.67	122.33	126.11	I1	133.67	133.17	129.00	131.94	I1	115.67	99.33	19.33	78.11	I1	4.00	4.67	7.07	5.25
	I2	121.83	118.50	117.83	119.39	I2	128.50	124.17	119.83	124.17	I2	101.00	95.00	22.00	72.67	I2	5.57	7.88	11.4	8.30
	I3	116.17	119.33	117.33	117.61	I3	125.83	123.33	122.67	123.94	I3	84.33	74.33	12.00	56.89	I3	5.76	6.26	9.43	7.15
	I4	114.00	96.33	92.67	101.00	I4	120.00	113.00	107.00	113.33	I4	71.67	38.00	10.67	40.11	I4	9.09	8.42	13.33	8.91
	Mean	120.08	115.46	112.54		Mean	127.00	123.42	119.63		Mean	84.33	76.67	16.00		Mean	6.11	6.81	9.22	
		S. Em ±		C.D @ 5%		S. Em ±		C.D @ 5%			S. Em ±		C.D @ 5%			S. Em ±		C.D @ 5%		
Main plot		2.50		8.66		3.37		11.67			2.7		9.34			0.49		1.69		
Sub plot		1.28		3.84		0.65		1.94			2.22		6.65			0.25		0.75		
M x S		2.56		7.67		1.30		3.88			4.44		13.3			0.50		1.50		
CV (%)		6.47				8.20					13.07					19.7				

Main plot treatments irrigation (I): I1: 100% CPE, I2: 80% CPE, I3: 60% CPE, I4: 40% CPE
Sub plot treatments mulch (M): M1: Without mulch, M2: Sugarcane trash, M3: Polythene mulch

Table 3: Herbage yield of garden rue at final harvest as influenced by different levels of irrigation and mulches

Treatments	Herbage yield																			
	Mulch																			
	Fresh herb (g/plant)					Fresh herb (t/ha)					Dry herb (g/plant)					Dry herb (t/ha)				
Irrigation levels		M1	M2	M3	Mean		M1	M2	M3	Mean		M1	M2	M3	Mean		M1	M2	M3	Mean
	I1	211.80	237.00	356.6	268.4	I1	8.05	9.40	14.20	10.56	I1	41.02	80.20	84.93	68.71	I1	1.88	3.53	3.60	3.00
	I2	227.07	314.30	469.7	337.0	I2	9.01	12.70	18.47	13.39	I2	81.77	92.54	116.8	97.05	I2	3.00	3.90	4.89	4.13
	I3	179.57	190.33	291.9	220.6	I3	6.92	7.52	11.30	8.59	I3	45.46	53.64	59.85	52.98	I3	2.13	2.40	2.59	2.37
	I4	174.80	169.93	218.1	187.6	I4	7.23	6.70	8.64	7.52	I4	51.33	54.87	54.80	53.67	I4	2.24	2.08	2.48	2.26
	Mean	198.3	227.8	334.1		Mean	7.80	9.08	13.17		Mean	54.89	70.31	79.11		Mean	2.46	2.98	3.40	
		S.Em ±		C.D @ 5%		S.Em ±		C.D @ 5%			S.Em ±		C.D @ 5%			S.Em ±		C.D @ 5%		
Main plot		11.76		40.71		0.49		1.69			1.32		4.55			0.07		0.25		
Sub plot		10.79		32.35		0.43		1.30			1.62		4.86			0.09		0.28		
M x S		21.58		64.70		0.87		2.61			3.25		9.73			0.19		0.57		
CV (%)		13.93				14.61					5.80					7.47				

Main plot treatments irrigation (I): I1: 100% CPE, I2: 80% CPE, I3: 60% CPE, I4: 40% CPE
CPE: Cumulative Pan Evaporation
Sub plot treatments mulch (M): M1: Without mulch, M2: Sugarcane trash, M3: Polythene mulch

Conclusions

Among treatments, combination of I2M3:Irrigation 80% CPE + polythene mulch showed maximum growth parameters such as plant height (43.13 cm), number of branches per plant (22.80), plant spread (40.17 cm), soil moisture (17.50%) and yield attributes like fresh herbage yield (18.47 t/ha), dry herbage yield (4.89 t/ha) at final harvest. Significantly in weed density (10.67 m2), water use efficiency (13.33 kg/ha/cm3), minimum days to first flowering (92.67 days) and 50% flowering (107.00 days) at final harvest were recorded in combination of I4M3: Irrigation 40% CPE + polythene mulch.

References

1. Bhardwaj RL, Sundria MM, Kumhar SR, Kumar N. Effect of irrigation methods and mulching on growth and yield parameters of chilli (*Capsicum annum* L.) in arid condition. J. Spices Aromat. Crops 2018;27(1):81-87.

2. Chauhan SK. Effect of salinity levels, water regimes and nitrogen on crop growth and yield of aloe. Ann. Plant Soil Res 2013;15(1):58-61.
3. Harshita S, Panghal VVPS, Duhan DS. Irrigation and nutritional effect on growth and seed yield of coriander (*Coriandrum sativum* L.). J Plant Nutr 2018;41:(13)1705-1710.
4. Kumar R, Sood S, Sharma S, Kasana RC, Pathania VL, Singh B, Singh RD. Effect of plant spacing and organic mulch on growth, yield and quality of natural sweetener plant stevia and soil fertility in western Himalayas. Int. J Plant Prod 2014;8(3):1735-6814.
5. Milesi S, Massot B, Gontier E, Bourgaud F, Guckert A. *Ruta graveolens* L. A promising species for the production of furanocoumarins., Plant Sci 2001;161:189-199.
6. Palada MC, Crossman SMA, Kowalski JS, Collingwood CD. Evaluation of organic and synthetic mulches for basil production under drip irrigation. J. Herbs Spices. Amp Med Plants 2008;6(4):39-48.
7. Parray SA, Bhat JU, Ahmad G, Jahan N, Sofi G, Iqbal SMF. *Ruta graveolens*: from traditional system of medicine to modern pharmacology: an overview. Am. J Pharm. Tech Res 2012;2(2):2249-3387.
8. Ram MD, Ram S, Singh M. Irrigation and nitrogen requirements of bergamot mint on a sandy loam soil under sub-tropical. Agric. Water Manag 1995;27:45-54.
9. Ram M, Ram D, Roy SK. Influence of an organic mulching on fertilizer nitrogen use efficiency and herb and essential oil yields in geranium (Pelargonium graveolens). Bioresour. Technol 2013;87:273-278.
10. Sarrou E, Chatzopoulou P, Koutsos TV, Katsiotis S. Herbage yield and essential oil composition of sweet basil (Ocimum basilicum L.) under the influence of different mulching materials and fertilizers. J Med. Plants Stud 2016;4(1):111-117.
11. Sharma S, Patel RH, Sharma OP. Effect of irrigation scheduling and organic manures on moisture extraction pattern, consumptive use, water use efficiency and yield of fenugreek. Int. J Seed Spices 2016;6(2):13-18.
12. Singh M, Chandrashekaran RS, Rao G, Rao EVS. Effect irrigation and levels of nitrogen on herb and oil yield of geranium (Pelargonium sp.) under semiarid tropical conditions. J Essent. Oil Res 1996;8:653-656.
13. Sundraraj N, Nagaraju SC, Venkataramu MN, Jaganath MK. Design and analysis of field experiments, University of Agricultural Sciences press publication 1972.