Indian Journal of Agricultural Sciences **86** (3): 321–5, March 2016/Article
https://doi.org/10.56093/ijas.v86i3.56869

Stability analysis of nutrient scheduling for lean season flowering in Arabian jasmine (*Jasminum sambac*)

SUJATHA A NAIR[1] and R VENUGOPALAN[2]

ICAR-Indian Institute of Horticultural Research, Hessaraghatta Lake Post, Bangalore, Karnataka 560 089

Received: 18 February 2015 ; Accepted: 26 October 2015

ABSTRACT

Stability parameters were estimated for eight characters of *Jasminum sambac* (L.) Aiton cv. Single mogra under five nutrient schedules for lean season flowering during three years 2008-11. The analysis of variance showed that the nutrient schedules had significant responses towards different environment changes. Significant nutrient schedule × Environment interactions were detected for all the eight characters, ie. number of leaves at flowering, days to flower initiation, number of flower buds/plant, hundred bud weight, yield/plant, bud length, pedicel length and flower diameter. The treatment T_4 (application of 10 kg FYM/plant/year and 120:240:240 g/plant of NPK in four equal splits during February, May, September, December was found to improve lean season yield and is a stable nutrient schedule for the characters, viz. number of leaves at flowering, number of flower buds/plant and yield/plant.

Key words: Jasmine, Lean season flowering, Nutrient dose, Stability parameters

Arabian jasmine (*Jasminum sambac* (L.) Aiton) belonging to the family Oleaceae, is a fragrant flower commercially cultivated for fresh flowers and extraction of essential oil. The peak flowering in *Jasminum sambac* is during March to June and then it gradually declines. The lean period is in winter from November to February, during which flower production is drastically reduced, besides production of poor quality flowers. Advancing the pruning time to September resulted in flower production during winter (Sujatha *et al*. 2009). Application of the recommended nutrients as split doses at certain critical stages of crop development could result in better growth, yield and quality of flowers. Flower forcing and nutrient scheduling during the cropping period for lean season yield increases the profitability for farmers. The nutrient scheduling, i e selection of the optimum nutrient dose and time of application can be done based on the phenotypic stability. The nutrient dose, environment and their interaction as a source of variation could help in identifying the nutrient doses with more stable performance for different traits. Stability analysis would result in the identification of the best nutrient schedule for increasing the quantity and improving the quality of lean season flowering for a wide range of environments.

MATERIALS AND METHODS

The present study was carried out during 2008-2011 in *Jasminum sambac* cv. Single Mogra at the ICAR-Indian Institute of Horticultural Research, Hessaraghatta, Bangalore. The experiment was laid out in randomized block design with five treatments replicated four times with six plants/ replication. The treatments consisted of split doses of recommended inorganic fertilizers ie. application of NPK at different intervals during the crop period. The treatments are presented in Table 1.

During the first two years of the plant growth, one fourth and during the third year half of the recommended dose inorganic nutrients were applied. Thereafter, full dose

Table 1 Treatment details for nutrient dose and time of application

Treat-ment	FYM (kg/plant/ yr)	NPK (g/plant)	Number of splits	Time of application
T_1	10	120:240:240	2	1/2 N + full P and K at planting/pruning; remaining 1/2 N after first flowering flush
T_2	10	120:240:240	3	Equal splits of NPK in January, May, September
T_3	10	120:240:240	4	Equal splits of NPK January, April, July, October
T_4	10	120:240:240	4	Equal splits of NPK February, May, September, December
T_5	10	120:240:240	6	Equal splits of NPK January, March, May, July, September, November

[1]Principal Scientist (e mail: sujathaanil@iihr.ernet.in), Division of Ornamental Crops, [2]Principal Scientist (e mail: venur @iihr.ernet.in), Section of Economics and Statistics

of nutrients was applied. The soil of the experimental plot was clay loam and the chemical analysis recorded initial organic carbon content (0.58%), available N (165 kg/ha), available P (85 kg/ha), available K (260 kg/ha), pH (6.8) and EC (0.23 dSm). The plants were pruned in September to a height of 45 cm above the ground level. Observations on the vegetative and floral traits were recorded during the lean season (November to February). With a view to ascertain the stable nutrient schedule for different plant traits over years (locally created environments), stability analysis was carried out following the model proposed by Eberhart and Russell (1966) for computing stability parameters, viz. mean of the trait (x_i), regression coefficient (b_i) and deviation from linear regression ($S^2\ d_i$). Regression coefficient of a stable treatment is equal to 1, and deviation from regression is 0 or close to 0. Those with regression coefficient >1 with least deviation from regression ($S^2\ d_i$) would be more adapted to favourable environmental conditions, those with regression coefficient <1 with least deviation from regression ($S^2\ d_i$) would be adapted to unfavourable environmental conditions (Finlay and Wilkinson 1963, Eberthart and Russel 1966).

RESULTS AND DISCUSSION

The influence of scheduling the split nutrient doses on the vegetative and floral characters during the three years of the trial and the pooled data have been presented in Table 2. Results from the pooled data are indicated in the treatment T_4, the maximum number of new leaves at flowering (105.92) and minimum number of days to flower initiation after pruning (17.58 days) was recorded. T_4 also recorded the maximum number of flower buds/plant during the lean season (191.2), hundred bud weight (20.75g) and yield per plant in winter months (41.08g). The treatment T_2 recorded the maximum values for bud length (2.27 cm), pedicel length (1.21 cm) and flower diameter (2.18 cm) all of which were at par with the treatment T_4 (2.23 cm, 1.18 cm and 2.17 cm for the same characters respectively). Split application of the recommended nutrient dose during the months of February, May, September, and December which coincided with the critical phases at the end of flowering flushes or after pruning might have resulted in better vegetative growth and thus increase in lean season flowering.

The analysis of variance for stability in the performance of the time of application of split nutrient doses and (N) across the three environments revealed that the mean squares were significantly different (Table 3) for all the traits *viz*. number of leaves at flowering, days to flower initiation, number of flower buds per plant, hundred bud weight, yield/plant, bud length, pedicel length and flower diameter. Significant difference was recorded for the linear component of interaction between the time of application of split nutrient doses (N) and environment (E).

Stability parameters

Stability of the nutrient schedules or the time of

Table 2 Effect of nutrient dose scheduling on yield and flower quality of lean season flowering in *Jasminum sambac* var. Single Mogra

Nutrient doses	No. of new leaves at flowering				Days to flower initiation after pruning				No. of flower buds / plant in lean season				Bud length (cm)			
	I yr	II yr	III yr	Pooled	I yr	II yr	III yr	Pooled	I yr	II yr	III yr	Pooled	I yr	II yr	III yr	Pooled
T1	64.46	76.46	83.50	74.81	14.75	18.00	22.50	18.42	100.80	132.83	151.79	128.4	2.18	2.23	2.08	2.16
T2	91.25	105.04	111.63	102.64	14.00	19.25	22.83	18.69	97.29	167.44	215.00	159.9	2.25	2.37	2.19	2.27
T3	66.46	90.92	97.13	84.83	14.33	19.67	22.75	18.92	56.17	148.50	218.67	141.1	1.69	2.13	2.23	2.02
T4	100.21	106.88	110.67	105.92	13.75	16.50	22.50	17.58	117.58	186.46	269.63	191.2	1.94	2.31	2.43	2.23
T5	48.08	84.17	90.54	74.26	14.00	19.17	22.83	18.67	80.67	139.92	209.63	143.4	2.06	2.26	2.14	2.15
CD (*P*=0.05)	18.67	NS	NS	15.53	0.20	2.03	NS	1.02	17.25	16.07	57.84	20.82	0.03	NS	0.12	0.24
	Pedicel length (cm)				*Flower diameter (cm)*				*100 bud weight (g)*				*Yield per plant (g)*			
T1	1.18	1.20	1.11	1.17	2.27	2.18	1.74	2.07	18.08	20.29	19.70	19.35	18.33	26.89	30.22	25.14
T2	1.23	1.26	1.14	1.21	2.26	2.25	2.03	2.18	17.33	20.40	21.69	19.80	16.57	34.07	47.73	32.79
T3	0.91	1.12	1.17	1.07	1.72	1.96	1.91	1.86	17.34	20.61	20.26	19.40	9.11	30.41	45.35	28.29
T4	1.05	1.22	1.26	1.18	2.00	2.27	2.24	2.17	18.86	20.98	22.40	20.75	22.37	39.17	61.70	41.08
T5	1.12	1.19	1.12	1.14	2.05	2.25	1.98	2.09	18.20	19.84	19.98	19.34	14.85	27.77	42.29	28.30
CD (*P*=0.05)	NS	0.11	0.07	0.13	0.02	0.27	0.15	0.27	NS	NS	0.89	0.69	3.25	3.29	12.61	4.47

application of split nutrient doses over different environments is a requisite for sustainable crop production during the lean season. The stability parameters are presented in Table 4 and the grouping of the parameters based on the response to different environments is presented in Table 5. The stable nutrient split doses had regression coefficient (b_i) equal to one, mean square deviation ($S^2 d_i$) equal to zero with high mean performance.

Number of leaves at flowering

All the treatments were found to be stable for this character with b_i=1 and $S^2 d_i$=0 and suitable for a wide range of environment. The treatment T_4 recorded the maximum number of leaves at flowering. The split application of the nutrients in any given environment might have contributed to the increase in vegetative growth as is also recorded in *Jasminum sambac* by Sharom *et al*. (2012).

Days to flower initiation

From Table 4, it is evident that the treatments T_2, T_4 and T_5 were suitable for favourable environments with b_i >1 and had high responsiveness to change of environment. Treatments T_1 and T_3 with b_i < 1 had poor sensitivity to change of environment for the days to flower initiation. None of the treatments were stable for this character. Similar trends were observed for stability analysis of biostimulants in rose by Gupta *et al*. (2010)

Number of flower buds/plant

The treatment T_4 recorded the maximum number of flower buds in winter season and was stable with b_i=1 and $S^2 d_i$=0. Treatments T_1 and T_3 were also stable for this character. These treatments are suitable for a wide range of environments. The treatment T_2 was suitable for poor environment with b_i < 1 and T_3 with b_i >1 performs well only under favourable conditions. Similar trend was observed in stability studies on biostimulants in rose for the number of flowers by Gupta *et al*. (2012).

Hundred bud weight

For hundred bud weight, the treatments T_1, T_2, T_5 were stable with bi=1 and $S^2 d_i$=0. The other two treatments T_3 and T_4 performed well under favourable conditions.

Yield /plant

The treatments T_1, T_2, T_3, T_4 and T_5 with non-significant deviation from the regression are stable for yield and are suitable for a wide range of environments. Flower yield is highly influenced by the fertilizer doses in *Jasminum sambac* (Fernando *et al*. 2010). The availability of the nutrients at critical stage of plant growth also influences the flower yield which is evident from the study.

Bud length

In case of flower quality, bud length is an important aspect. The treatments T_1, T_2, T_3 and T_5 were stable under

Table 3 Stability analysis for different nutrient doses on lean season flowering in *Jasminum sambac* cv. Single mogra

Source of variation	df	Mean Sum of Squares							
Eberhart- Russell (ER) Method		Number of leaves at flowering	Days to flower initiation	Number of flower buds/plant	Hundred bud weight (g)	Yield /plant (g)	Bud length (cm)	Pedicel length (cm)	Flower diameter (cm)
Nutrient doses	4	680.212*	0.807*	1757.71*	1.080*	115.240*	0.027*	0.008*	0.049*
Nutrient doses × Environment (Linear)	4	92.506*	0.108*	952.546*	0.527*	56.878*	0.029*	0.006*	0.009*
Pooled deviations	5	3.353	0.734	45.277	0.296	3.876	0.014	0.006	0.034
Average error	36	76.225	0.332	136.989	0.153	6.338	0.019	0.006	0.024

*Significant at P=0.05

Table 4 Stability parameters of vegetative and floral characters for different nutrient doses in *Jasminum sambac* cv. Single mogra

Nutrient doses	Number of leaves at flowering			Days to flower initiation			Number of flower buds/plant			Hundred bud weight (g)		
	x_i	b_i	$S^2 d_i$	x_i	b_i	$S^2 d_i$	x_i	b_i	$S^2 d_i$	x_i	b_i	$S^2 d_i$
T_1	74.80	0.743	-72.7	18.42	0.90	0.002	128.4	0.418	-119.2	19.3	0.68	0.215
T_2	102.6	0.808	-74.6	18.69	1.03	0.031	159.9	0.964	-93.13	19.8	1.43	0.129
T_3	84.83	1.263	-75.2	18.92	0.99	0.382	141.1	1.329	-107.1	19.4	1.13	0.163
T_4	105.9	0.409	-75.2	17.58	1.02	1.639	191.2	1.238	-52.64	20.7	1.10	0.357
T_5	74.26	1.777	-66.5	18.67	0.02	-0.04	143.4	1.051	-86.38	19.3	0.63	-0.147
	Yield per plant (g)			*Bud length (cm)*			*Pedicel Length (cm)*			*Flower diameter (cm)*		
T_1	25.14	0.410	-2.874	2.16	0.031	-0.007	1.17	0.045	-0.001	2.07	1.93	0.060
T_2	32.79	1.068	-5.601	2.27	0.259	-0.005	1.21	0.041	0.001	2.18	0.97	-0.011
T_3	28.29	1.243	-3.180	2.02	2.159	0.000	1.07	2.373	0.005	1.86	0.38	0.006
T_4	41.08	1.342	4.064	2.23	1.838	0.003	1.18	1.903	0.001	2.17	0.35	0.018
T_5	28.30	0.937	-4.720	2.15	0.714	-0.015	1.14	0.638	-0.005	2.09	1.36	-0.023

Table 5 Grouping of the nutrient doses based on results of stability analysis

Characters	Nutrient dose suitable for wide range of environments b_i =1 and S^2 d_i =0	Nutrient dose suitable for poor environment b_i <1 and S^2 d_i =0	Nutrient dose suitable for favourable environment b_i >1 and S^2 d_i =0
Number of leaves at flowering	T_1,T_2,T_3,T_4,T_5		
Days to flower initiation		T_1,T_3	T_2,T_4,T_5
Number of flower buds/ plant	T_1,T_3,T_4	T_2	T_5
Bud length (cm)	T_1,T_2,T_3, T_5		T_4
Pedicel length (cm)	T_1,T_2,T_5		T_3,T_4
Flower diameter (cm)	T_5	T_2,T_3,T_4	T_1
Hundred bud weight (g)	T_1,T_2, T_5		T_3,T_4
Yield/plant (g)	T_1,T_2,T_3,T_4,T_5		

a wide range of environments with bi=1 and S^2 d_i=0. Treatment T_4 with b_i >1 performed well under favourable conditions. Gupta *et al*. (2010) reported that environment has a favourable effect on flower size in rose.

Pedicel length

The pedicel length determines the suitability of the jasmine buds for value addition especially for making garland and venis. The nutrient split treatments T_1, T_2, T_5 were found to be stable with bi=1 and S^2 d_i=0 and suitable for a wide range of environments. Pedicel length in jasmine is highly influenced by the environment and the cultural practices with special reference to nutrient availability for bud development.

Flower diameter

The treatment T_5 only showed stability under a wide range of environments with bi=1 and S^2 d_i=0. The treatments T_2, T_3, T_4 were suitable for poor environment with b_i < 1. Varied responses for flower diameter were reported by Sreenivasulu (2004) in China aster and Patil *et al*. (2011) in marigold with changing environments.

REFERENCES

Eberhart S A and Russell W A.1966. Stability parameters for comparing varieties. *Crop Science* **6**: 36–40.

Fernando C Sanchez Jr, Dante Santiago and Caroline P Khe. 2010. Production management practices of jasmine (*Jasminum sambac* [L.] Aiton) in the Philippines. *Journal of ISSAAS* **16**(2): 126–36.

Finlay K W and Wilkinson G N. 1963. The analysis of adaptation in plant-breeding programme. *Australian Journal of Agricultural Research* **14**: 742–54.

Gupta R K, Gupta Y C, and Moona. 2010.Stability analysis of rose cultivar 'First Red' under different biostimulant applications. *Middle East Journal of Scientific Research* **6**(1): 83–7

Gupta Y C, Gupta R K, Moona and Dhiman S R. 2012. Stability analysis of different biostimulant applications to flowering characters of rose (*Rosa* hybrida) cultivar First Red. *Indian Journal of Agricultural Sciences* **82**(2): 106–11.

Patil K V, Kulkarni B S, Reddy B S, Jagadeesha R C, Prakash K and Ajit I. 2011. Stability analysis in marigold (*Tagetes erecta* L.) for flower yield and quality parameters. *Research Journal of Agricultural Sciences*, **2**(2): 237–40.

Shoram, Parekh N S, Upadhyay N V, Karapatiya B A and Patel H C. 2012. Effect of nitrogen and phosphorus on vegetative growth and flower yield of Jasmine (*Jasminum sambac* Ait.) cv. 'Double' under middle Gujarat conditions. *Asian Journal of Horticulture* **7**(1): 52–4.

Sreenivasulu G B. 2004. Stability analysis in China aster (*Callistephus chinensis* L. Nees.) varieties. M Sc (Hort.) thesis, University of Agricultural Sciences, Dharwad, Karnataka.

Sujatha A Nair**,** Sujatha K and Venugopalan R.2009.Influence of pruning time on enhancing the yield and quality of *Jasminum sambac* flowers during off-season. *Indian Journal of Agricultural Sciences* **79**(11): 857–60.