



GROWTH INDICES AND YIELD AS INFLUENCED BY SOWING DATES AND VARIETY IN FENUGREEK

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Abstract

An investigation was conducted at Horticultural College and Research Institute, Venkataramannagudem, Dr. Y.S.R. Horticultural University with an objective of evaluating the effect of sowing date, variety and their interaction on growth, yield and quality of seed fenugreek in order to assess its fitment into sequence cropping under delayed sowing conditions. A total of five varieties *viz.*, Hissar Sonali, Rmt-1, Co-1, Rajendrakranti and Co-2 were evaluated on five sowing dates at 15-day interval starting from 15th October to 15th December in split plot design with five main plots as sowing dates and five sub-plots as varieties. There were significant differences in the vegetative and yield parameters, which were revealed by analyzing various growth indices like AGR, CGR, RGR, LAI, LAD and NAR. The maximum values in respect of yield parameters recorded by Co-1 and Co-2 by sowing on 15th October, it is also observed that Co-1 and Co-2 varieties were at par in some of these characters and on the other hand at lower level Rmt-1 and Rajendrakranti were on par with one another. Regarding the sowing dates 15th October was found to be on par with 1st November and similarly 1st December and 15th December were also on par though recorded minimum values in respect of yield parameters.

Key words : Fenugreek, harvest index, sowing date, variety, growth indices.

Introduction

Fenugreek (*Trigonella foenum-graecum* L.) is an important seed spice, originated from South-Eastern Europe and belongs to the family Leguminosae. Fenugreek seed is one of the principal odoriferous constituents of curry powder. The dried seeds, leaves and tender shoots are all consumed and are valued as food, flavouring agent and medicine. Aggarwal *et al.* (2005) stated that its leaves are specially used for vegetable purpose.

Fenugreek is mainly grown as leafy vegetable throughout India and there is ample scope for its cultivation as seed spice (Amal *et al.*, 2012). It is a short duration crop fitting well in several cropping systems. Seed crop requires cool dry climate and takes about three months duration thus fitting well as a *rabi* crop after the harvest of *kharif* main crops like paddy, chillies, cotton and pigeon pea.

India is the largest producer of fenugreek, where it

is the third largest spice after coriander and cumin. It is mainly cultivated in Rajasthan, Gujarat, Madhya Pradesh and to a limited extent in Andhra Pradesh, Tamil Nadu, Haryana, Maharashtra and Punjab (Meena *et al.*, 2014). Rajasthan is considered as “fenugreek bowl” of the country. Fenugreek is mainly grown as leafy vegetable throughout India and there is ample scope for its cultivation as seed spice (Amal *et al.*, 2012). It is a short duration crop fitting well in several cropping systems. Seed crop requires cool dry climate and takes about three months duration thus fitting well as a *rabi* crop after the harvest of *kharif* main crops like paddy, chillies, cotton and pigeon pea. It is well known that among yield influencing factors date of planting is said to be the major one having direct influence on growth, yield and quality of fenugreek.

In general, the crop requires cool climate during vegetative growth and warm dry climate during maturity. During *rabi* season sowing in the month of October is recommended both for seed and leaf crop under coastal A. P. conditions. However, delay in sowing has become a common feature due to vagaries in monsoon and far

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approachability to canals in certain localities. Under these circumstances, seed fenugreek is one among such choices for *rabi* sequence crop. However, time of sowing varies according to the cultivar selected for cultivation and agro-climatic conditions and also there are several modern cultivars developed by different research institutes. But their performance with respect to Harvest index and other related yield parameters under different agro-climatic conditions was not uniform. The useful interactions between sowing time and cultivar offer us a scope to select the best sowing time for a particular seed fenugreek variety and *vice versa*.

Materials and Methods

A field experiment was conducted on growth and yield parameters of fenugreek at Horticultural College and Research Institute, Venkataramannagudem, Dr. Y. S. R. Horticultural University during 2014-15. A total of five varieties *viz.*, Hissar Sonali, Rmt-1, Co-1, Rajendrkranti and Co-2 were evaluated on five sowing dates at 15-day interval starting from 15th October to 15th December in split plot design with five main plots as sowing dates and five sub-plots as varieties. Recommended practices as per the university package were followed. All the observations on growth parameters were recorded at different growth stages of plant and observations on yield and yield components of fenugreek were recorded after harvesting of the crop. The growth indices were calculated using the following formulae :

$$\text{CGR (Crop growth rate)} = \frac{1}{P} \times \frac{W_2 - W_1}{T_2 - T_1} \text{ mg/m}^2 \text{ ds}^{-1}$$

$$\text{RGR (Relative growth rate)} = \frac{1}{W_1} \times \frac{W_2 - W_1}{T_2 - T_1} \text{ mg/g ds}^{-1}$$

$$\text{NAR (Net assimilation rate)} = \frac{W_2 - W_1 \times \log_e L_2 - \log_e L_1}{\log_e L_2 - L_1 \times \log_e T_2 - T_1}$$

Where,

W_1, W_2 = Total dry weight

L_1, L_2 = Leaf area at T_1 and T_2

$$\text{LAI (Leaf area index)} = \frac{\text{Leaf area}}{\text{Ground area}}$$

$$\text{LAD (Leaf area duration)} = (\text{LA}_1 + \text{LA}_2) \times \frac{T_2 - T_1}{2}$$

Results and Discussion

Leaf area (cm²)

The highest leaf area at maturity (21.60 cm²) was recorded by the plants sown on 15th October followed by

1st November sown plants (18.60 cm²). The lowest value with respect to leaf area at maturity (14.53 cm²) was observed in the 15th December sown plots. Among the varieties, the maximum leaf area at maturity (18.60 cm²) was observed in Co-1, which was on par with Co-2 (18.13 cm²) and the lowest value with respect to leaf area was recorded by the variety Rmt-1 (16.27 cm²).

Dry weight of the plant (g)

The maximum dry weight at maturity (15.33 g) was recorded by the plants sown on 15th October followed by 1st November sown plants (13.79 g). The minimum dry weight at maturity (8.73 g) was found in the 15th December sown plots. Among the varieties, the highest value with respect to dry weight at maturity (13.66 g) was observed in Co-1, which was on par with Co-2 (12.80 g) and Hissar sonali (11.93 g) and the lowest value with respect to dry weight was recorded by the variety Rmt-1 (10.06 g).

The highest dry weight and leaf area was recorded by the 15th October sown crop as compared to those sown on 1st November and later dates at various growth stages (tables 1 and 2). This might be due to the better vigour of the crop sown on 15th October as discussed earlier due to favourable climatic parameters. The early sown plants could have benefited by the advantage of better vigour leading to maximum photosynthetic surface as there was more number of leaves and all of them reached maximum size thus resulting in a higher leaf area as compared to late sown fenugreek crop. The maximum photosynthetic surface with large number of full grown and healthy leaves as produced by 15th October sown plants might have harvested maximum amount of light and synthesized relatively a high amount of photosynthates as evident from the the higher values of fresh weight of whole plant and its parts recorded by 15th October sown plants. As compared to October sown plants, the late sown plants recorded a lower photosynthetic surface and lesser amount of photosynthates being produced, could not excel over the October sown plants in fresh weight of plants. More the fresh weight more was the dry weight as observed from the data obtained from various sowing dates, varieties and their interactions. Significant differences in respect of fresh and dry weight of plant parts as well as leaf area were also reported by Aggarwal *et al.* (2012), Halesh *et al.* (2000), Gowda *et al.* (2006) in fenugreek; Chaudhari *et al.* (1995) in coriander; Susil and Rajkumar (2011) in ajowan.

Absolute growth rate (g/day)

The maximum value of absolute growth rate both in 30-60 DAS and 60-90 DAS was recorded by Co1 (0.32g)

Table 1 : Leaf area (cm²) as influenced by sowing date and variety in fenugreek.

Date of sowing/ Variety	30 DAS					60 DAS					At maturity						
	15-Oct	1-Nov	15-Nov	1-Dec	15-Dec	Mean	15-Oct	1-Nov	15-Nov	1-Dec	15-Dec	Mean	15-Oct	1-Nov	15-Nov	1-Dec	15-Dec
Hissar sonali	12.00	11.00	9.66	9.00	8.00	9.93	19.00	16.00	14.33	12.66	14.73	22.00	19.00	17.00	15.00	14.00	17.40
Rmt-1	10.00	8.33	8.00	7.00	6.00	7.87	17.00	14.00	13.00	12.00	13.40	20.00	17.00	16.00	14.33	14.00	16.27
Co-1	14.00	12.66	11.66	10.00	10.00	11.66	19.00	17.33	15.66	14.66	15.93	23.00	19.00	18.00	16.00	17.00	18.60
Rajendrakanthi	11.00	10.00	7.66	8.00	7.00	8.73	18.00	15.00	13.33	12.33	14.00	21.00	18.00	16.00	15.00	14.00	16.80
Co-2	13.00	11.66	10.66	10.00	9.00	10.86	20.00	16.33	15.33	13.66	15.86	22.00	20.00	18.00	17.00	13.66	18.13
Mean	12.00	10.73	9.53	8.80	8.00	9.81	18.60	15.73	14.33	13.06	14.78	21.60	18.60	17.00	15.46	14.53	17.44
Factor	S.Em \pm					CD at 5% LOS	Factor					S.Em \pm	CD at 5% LOS				
Sowing date	0.36					1.04	Sowing date					0.37	1.07				
Variety	0.37					1.05	Variety					0.48	1.38				
Interaction	0.68					1.94	Interaction					0.85	2.42				

Table 2 : Dry weight of the plant (g) as influenced by sowing date and variety in fenugreek.

Date of sowing/ Variety	30 DAS					60 DAS					At maturity						
	15-Oct	1-Nov	15-Nov	1-Dec	15-Dec	Mean	15-Oct	1-Nov	15-Nov	1-Dec	15-Dec	Mean	15-Oct	1-Nov	15-Nov	1-Dec	15-Dec
Hissar sonali	0.50	0.11	0.12	0.15	0.14	0.20	4.30	3.96	3.86	3.76	3.91	15.33	13.66	11.66	10.00	9.00	11.93
Rmt-1	0.26	0.10	0.10	0.13	0.12	0.14	4.10	3.90	3.80	3.70	3.82	13.33	12.33	9.66	8.00	7.00	10.06
Co-1	0.63	0.38	0.36	0.17	0.16	0.34	4.33	4.16	4.00	3.90	4.02	17.33	15.66	13.00	12.00	10.33	13.66
Rajendrakanthi	0.36	0.10	0.11	0.14	0.13	0.17	4.20	3.93	3.83	3.73	3.86	14.33	12.66	10.66	9.00	7.33	10.80
Co-2	0.56	0.33	0.14	0.16	0.15	0.27	4.40	4.06	3.90	3.80	3.97	16.33	14.66	12.00	11.00	10.00	12.80
Mean	0.46	0.20	0.17	0.15	0.14	0.22	4.27	4.00	3.88	3.78	3.92	15.33	13.79	11.40	10.00	8.73	11.85
Factor	S.Em \pm					CD at 5% LOS	Factor					S.Em \pm	CD at 5% LOS				
Sowing date	0.03					0.08	Sowing date					0.03	0.08				
Variety	0.03					0.09	Variety					0.05	0.15				
Interaction	0.05					0.15	Interaction					0.08	0.22				

at the time of 15th October sown (0.37g). The difference between the AGR values between first and second spells was at maximum by the crop sown on 15th October and the cultivar Co-1 as well their combination.

Crop growth rate (g/day)

The maximum value of crop growth rate both in 30-60 DAS and 60-90 DAS was recorded by Co1 (9.19g) at the time of 15th October sown (10.59g). The difference between the CGR values between first and second spells was at maximum by the crop sown on 15th October and the cultivar Co-1 as well their combination.

Relative growth rate (g/day)

The maximum value of relative growth rate both in 30-60 DAS and 60-90 DAS was recorded by Co1 (13.63g) at the time of 15th October sown (15.30g). The difference between the RGR values between first and second spells was at maximum by the crop sown on 15th October and the cultivar Co-1 as well their combination.

Leaf area index

The maximum value of leaf area index at different growth stages of plant *i.e.* 30, 60 and 90 days after sowing was recorded by Co1 (531.0) at the time of 15th October sown (620.0). The difference between the CGR values between first and second spells was at maximum by the crop sown on 15th October and the cultivar Co-1 as well their combination.

Leaf area duration

The maximum value of leaf area duration both in 30-60 DAS and 60-90 DAS was recorded by Co1 (517.95) at the time of 15th October sown (603.0). The difference between the CGR values between first and second spells was at maximum by the crop sown on 15th October and the cultivar Co-1 as well their combination.

Net assimilation rate (g/sq.cm)

The maximum value of net assimilation rate both in 30-60 DAS and 60-90 DAS was recorded by Co1 (0.0080) at the time of 15th October sown (0.0080). The difference between the CGR values between first and second spells was at maximum by the crop sown on 15th October and the cultivar Co-1 as well their combination.

Weight of pods per ha(t)

The maximum weight of pods per ha (3.06 t) was recorded by the plants sown on 15th October followed by 1st November sown plants (2.75 t). The minimum weight of the pods per ha (1.77 t) was observed in the 15th December sown plots. Among the varieties, the highest weight of the pods per ha (2.70 t) was observed in Co-1, which was on par with Co-2 (2.52 t) and Hissar sonali

Table 3 : Absolute growth rate as influenced by date of sowing and variety in fenugreek.

Date of sowing/ Variety	Absolute growth rate (g per day) (30-60 days)					Absolute growth rate (g per day) (60-90 days)					Difference in AGR (g per day) (60-90 days)										
	15-Oct	1-Nov	15-Nov	1-Dec	15-Dec	Mean	15-Oct	1-Nov	15-Nov	1-Dec	15-Dec	Mean	15-Oct	1-Nov	15-Nov	1-Dec	15-Dec	Mean			
Hissar sonali	0.13	0.13	0.12	0.12	0.12	0.12	0.37	0.32	0.26	0.21	0.18	0.27	0.24	0.20	0.14	0.09	0.06	0.14			
Rmt-1	0.13	0.13	0.12	0.12	0.12	0.12	0.31	0.28	0.20	0.14	0.11	0.21	0.18	0.15	0.07	0.02	0.00	0.09			
Co-1	0.12	0.13	0.12	0.12	0.12	0.12	0.43	0.38	0.30	0.27	0.22	0.32	0.31	0.26	0.18	0.15	0.10	0.20			
Rajendrakanthi	0.13	0.13	0.12	0.12	0.12	0.12	0.34	0.29	0.23	0.18	0.12	0.23	0.21	0.16	0.10	0.06	0.01	0.11			
Co-2	0.13	0.12	0.13	0.12	0.12	0.12	0.40	0.35	0.27	0.24	0.21	0.29	0.27	0.23	0.14	0.12	0.09	0.17			
Mean	0.13	0.13	0.12	0.12	0.12	0.12	0.37	0.33	0.25	0.21	0.17	0.26	0.24	0.20	0.13	0.09	0.05	0.14			
Factor	S.Em±					CD at 5% LOS	Factor					S.Em±					CD at 5% LOS				
Sowing date	0.0004					0.0011	Sowing date					0.0229					0.0656				
Variety	0.0004					0.0011	Variety					0.0229					0.0656				
Interaction	0.0009					0.0025	Interaction					0.0433					0.1236				

Table 4 : Crop growth rate as influenced by date of sowing and variety in fenugreek.

Date of sowing/ Variety	Crop growth rate (g per day) (30-60 days)					Crop growth rate (g per day) (60-90 days)					Difference in CGR (g per day) (60-90 days)																									
	15-Oct	1-Nov	15-Nov	1-Dec	15-Dec	Mean	15-Oct	1-Nov	15-Nov	1-Dec	15-Dec	Mean	15-Oct	1-Nov	15-Nov	1-Dec	15-Dec	Mean																		
Hissar sonali	3.74	3.84	3.73	3.59	3.50	3.68	10.55	9.26	7.37	5.82	4.93	7.59	6.81	5.42	3.64	2.23	1.43	3.91																		
Rmt-1	3.81	3.79	3.69	3.56	3.47	3.66	8.77	8.00	5.44	3.89	3.00	5.82	4.96	4.21	1.75	0.33	-0.47	2.16																		
Co-1	3.63	3.74	3.60	3.71	3.55	3.65	12.52	11.04	8.56	7.67	6.19	9.19	8.89	7.30	4.96	3.96	2.63	5.55																		
Rajendrakanthi	3.80	3.82	3.71	3.57	3.49	3.68	9.66	8.29	6.40	4.86	3.30	6.50	5.86	4.47	2.70	1.28	-0.19	2.83																		
Co-2	3.78	3.69	3.74	3.62	3.53	3.67	11.44	10.15	7.67	6.78	5.89	8.38	7.66	6.46	3.92	3.16	2.36	4.71																		
Mean	3.75	3.78	3.69	3.61	3.51	3.67	10.59	9.35	7.09	5.80	4.66	7.50	6.84	5.57	3.39	2.19	1.15	3.83																		
Factor	S.Em±					CD at 5% LOS	Factor					Factor					S.Em±					CD at 5% LOS														
Sowing date	0.0160					0.0457	Sowing date					Sowing date					Sowing date					0.5490					1.5692									
Variety	0.0142					0.0407	Variety					Variety					Variety					Variety					0.5490					1.5692				
Interaction	0.0252					0.0719	Interaction					Interaction					Interaction					Interaction					1.2469					3.5641				

Table 5 : Relative growth rate as influenced by date of sowing and variety in fenugreek.

Date of sowing/ Variety	Relative growth rate (g per g per day) (30-60 days)					Relative growth rate (g per g per day) (60-90 days)					Difference in RGR (g per g per day) (60-90 days)																									
	15-Oct	1-Nov	15-Nov	1-Dec	15-Dec	Mean	15-Oct	1-Nov	15-Nov	1-Dec	15-Dec	Mean	15-Oct	1-Nov	15-Nov	1-Dec	15-Dec	Mean																		
Hissar sonali	4.27	3.93	3.83	3.73	3.63	3.87	15.30	13.63	11.63	9.97	8.97	11.90	11.03	9.70	7.80	6.24	5.34	8.02																		
Rmt-1	4.07	3.87	3.77	3.67	3.57	3.79	13.30	12.30	9.63	7.97	6.97	10.03	9.23	8.43	5.86	4.30	3.40	6.24																		
Co-1	4.30	4.13	3.97	3.87	3.70	3.99	17.30	15.63	12.97	11.97	10.30	13.63	13.00	11.50	9.00	8.10	6.60	9.64																		
Rajendrakanthi	4.17	3.90	3.80	3.70	3.60	3.83	14.30	12.63	10.63	8.97	7.30	10.76	10.13	8.73	6.83	5.27	3.70	6.93																		
Co-2	4.37	4.03	3.87	3.77	3.67	3.94	16.30	14.63	11.97	10.97	9.97	12.76	11.93	10.60	8.10	7.20	6.30	8.83																		
Mean	4.23	3.97	3.84	3.74	3.63	3.88	15.30	13.76	11.36	9.97	8.70	11.82	11.06	9.79	7.52	6.22	5.07	7.93																		
Factor	S.Em±					CD at 5% LOS	Factor					Factor					S.Em±					CD at 5% LOS														
Sowing date	0.0877					0.2507	Sowing date					Sowing date					Sowing date					0.5504					1.5732									
Variety	0.0818					0.2338	Variety					Variety					Variety					Variety					0.5504					1.5732				
Interaction	0.0503					0.1437	Interaction					Interaction					Interaction					Interaction					1.2976					3.7089				

Table 6 : Leaf area index as influenced by date of sowing and variety in fenugreek.

Date of sowing/ Variety	Leaf area index (30 days)					Leaf area index (60 days)					Leaf area index (90 days)							
	15-Oct	1-Nov	15-Nov	1-Dec	15-Dec	Mean	15-Oct	1-Nov	15-Nov	1-Dec	15-Dec	Mean	15-Oct	1-Nov	15-Nov	1-Dec	15-Dec	Mean
Hissar sonali	400.00	366.67	322.00	300.00	266.67	331.07	633.33	533.33	477.67	422.00	388.67	491.00	733.33	633.33	566.67	500.00	466.67	580.00
Rmt-1	333.33	277.67	266.67	233.33	200.00	262.20	566.67	466.67	433.33	400.00	366.67	446.67	666.67	566.67	533.33	477.67	466.67	542.20
Co-1	466.67	422.00	388.67	333.33	333.33	388.80	633.33	577.67	522.00	488.67	433.33	531.00	766.67	633.33	600.00	533.33	566.67	620.00
Rajendrakanthi	366.67	333.33	255.33	266.67	233.33	291.07	600.00	500.00	444.33	411.00	377.67	466.60	700.00	600.00	533.33	500.00	466.67	560.00
Co-2	433.33	388.67	355.33	333.33	300.00	362.13	666.67	544.33	511.00	455.33	466.67	528.80	733.33	666.67	600.00	566.67	455.33	604.40
Mean	400.00	357.67	317.60	293.33	266.67	327.05	620.00	524.40	477.67	435.40	406.60	492.81	720.00	620.00	566.67	515.53	484.40	581.32
Factor	S.Em±					CD at 5% LOS	Factor					S.Em±	Factor					CD at 5% LOS
Sowing date	54.8395					156.7439	Sowingdate					18.6635	Sowing date					36.2240
Variety	51.3818					146.8611	Variety					18.6635	Variety					36.2240
Interaction	15.0836					43.1124	Interaction					42.3497	Interaction					131.3459

Table 7 : Leaf area duration as influenced by date of sowing and variety in fenugreek.

Date of sowing/ Variety	Leaf area duration (30-60 days)					Leaf area duration (60-90days)					Difference in Leaf area duration							
	15-Oct	1-Nov	15-Nov	1-Dec	15-Dec	Mean	15-Oct	1-Nov	15-Nov	1-Dec	15-Dec	Mean	15-Oct	1-Nov	15-Nov	1-Dec	15-Dec	Mean
Hissar sonali	465.00	405.00	359.85	324.90	294.90	369.93	615.00	525.00	469.95	414.90	384.90	481.95	150.00	120.00	110.10	90.00	90.00	112.02
Rmt-1	405.00	334.95	315.00	285.00	255.00	318.99	555.00	465.00	435.00	394.95	375.00	444.99	150.00	130.05	120.00	109.95	120.00	126.00
Co-1	495.00	449.85	409.80	369.90	345.00	413.91	630.00	544.95	504.90	459.90	450.00	517.95	135.00	95.10	95.10	90.00	105.00	104.04
Rajendrakanthi	435.00	375.00	314.85	304.95	274.95	340.95	585.00	495.00	439.95	409.95	379.95	461.97	150.00	120.00	125.10	105.00	105.00	121.02
Co-2	495.00	419.85	389.85	354.90	345.00	400.92	630.00	544.95	499.95	459.90	414.90	509.94	135.00	125.10	110.10	105.00	69.90	109.02
Mean	459.00	396.93	357.87	327.93	302.97	368.94	603.00	514.98	469.95	427.92	400.95	483.36	144.00	118.05	112.08	99.99	97.98	114.42
Factor	S.Em±					CD at 5% LOS	Factor					S.Em±	Factor					CD at 5% LOS
Sowing date	41.0124					117.2229	Sowing date					15.4813	Sowing date					10.2310
Variety	39.7632					113.6524	Variety					15.4813	Variety					10.2310
Interaction	14.9107					42.6183	Interaction					39.2185	Interaction					29.4210

Table 8 : Net assimilation rate as influenced by date of sowing and variety in fenugreek.

Date of sowing/ Variety	Net assimilation rate (g per sq.cm per day) (30-60 days)					Net assimilation rate (g per sq.cm per day) (60-90 days)					Difference in net assimilation rate												
	15-Oct	1-Nov	15-Nov	1-Dec	15-Dec	Mean	15-Oct	1-Nov	15-Nov	1-Dec	15-Dec	Mean	15-Oct	1-Nov	15-Nov	1-Dec	15-Dec	Mean					
Hissar sonali	0.0036	0.0042	0.0046	0.0049	0.0052	0.0045	0.0078	0.0080	0.0072	0.0065	0.0060	0.0071	0.0042	0.0039	0.0027	0.0017	0.0008	0.0026					
Rmt-1	0.0042	0.0050	0.0052	0.0056	0.0061	0.0052	0.0072	0.0079	0.0059	0.0047	0.0040	0.0059	0.0030	0.0029	0.0007	-0.0008	-0.0022	0.0007					
Co-1	0.0033	0.0037	0.0039	0.0044	0.0045	0.0040	0.0090	0.0092	0.0078	0.0077	0.0064	0.0080	0.0057	0.0055	0.0039	0.0032	0.0019	0.0040					
Rajendrakanthi	0.0039	0.0045	0.0053	0.0052	0.0056	0.0049	0.0075	0.0077	0.0068	0.0056	0.0042	0.0064	0.0036	0.0032	0.0015	0.0004	-0.0014	0.0015					
Co-2	0.0034	0.0039	0.0042	0.0045	0.0045	0.0041	0.0082	0.0085	0.0071	0.0068	0.0066	0.0074	0.0048	0.0046	0.0028	0.0023	0.0021	0.0033					
Mean	0.0037	0.0043	0.0046	0.0049	0.0052	0.0045	0.0080	0.0083	0.0069	0.0063	0.0054	0.0070	0.0043	0.0040	0.0023	0.0014	0.0002	0.0024					
Factor	S,Em±					CD at 5% LOS	Factor	S,Em±	Factor					S,Em±	CD at 5% LOS								
Sowing date	0.0005					0.0016	Sowing date					0.0012	Sowing date					0.0005	0.0015				
Variety	0.0005					0.0015	Variety					0.0012	Variety					0.0005	0.0015				
Interaction	0.0002					0.0005	Interaction					0.0019	Interaction					0.0010	0.0029				

(2.36t). The lowest value with respect to weight of the pods per ha was recorded by the variety Rmt-1 (1.97 t).

Seed yield per ha (kg)

The highest seed yield per ha (2130.81 kg) was recorded by the plants sown on 15th October followed by 1st November sown plants (1865.45 kg). The lowest seed yield per ha (1113.33 kg) was observed in the 15th December sown plots. Among the varieties, maximum seed yield per ha (1877.21 kg) was found in Co-1 and the lowest seed yield was observed in the Rmt-1 (1251.77 kg).

The data obtained on yield parameters revealed the better performance of 15th October sown crop compared to late sown crop. Among the varieties Co-1 recorded higher values in respect of many of the yield attributing parameters. The combination of both of them showed the highest value among the interactions. The plants sown on 15th October and those belong to Co-1 variety were found to produce more number pods per plant, maximum weight of the pods per plant, seed per pod as well as test weight. And also increment in biological yield is due to higher values for leaf area and dry matter accumulation, which improved the yield attributing characters and hence improvement in seed and straw yield. The analysis on absolute, crop and relative growth rates in comparison with leaf area index, leaf area duration and net assimilation rate revealed that the maximum pick up in growth rate, maximum leaf area per ground area over a period of time and maximum rate of assimilate accumulation per unit of photosynthetic surface were registered by the crop sown on 15th October as compared to delayed crops. Similarly maximum values of these indices were observed in the variety Co-1 as compared to other cultivars. This trend is indicative that such higher yield from the so called variety and sowing date might be due to a higher leaf area survived over the greater of period and maintained higher rate of assimilate accumulation over a greater period of time and finally leading to maximum harvestable biomass from the crop. Thus, the cumulative effect of the merit exhibited by these combinations could have ultimately led to increased seed yield per ha. This might be due to favourable environmental conditions available to the crop that was sown on 15th October as compared to late sown crops in case of both Co-1 and Co-2 varieties. These results are in conformity with the findings of Halesh (2000), Sheoran *et al.* (2000) and Gowda *et al.* (2006) in fenugreek; Batra *et al.* (2002), Saddam *et al.* (2012) in fennel, Chaudhari *et al.* (2009) in amaranthus, Seyyed *et al.* (2012), Bhadkariya *et al.* (2007) and Baswana *et al.* (1989) in coriander. Korla and Amit (2003) in

Table 9 : Weight of pods/ha and seed yield as influenced by date of sowing and variety in fenugreek.

Date of sowing/ Variety	Weight of pods per ha (kg)						Seed yield per ha (kg)					
	15-Oct	1-Nov	15-Nov	1-Dec	15-Dec	Mean	15-Oct	1-Nov	15-Nov	1-Dec	15-Dec	Mean
Hissar sonali	3.18	2.72	2.17	1.98	1.75	2.36	2196.48	1845.93	1414.40	1250.22	1094.91	1560.39
Rmt-1	2.73	2.39	1.75	1.55	1.43	1.97	1810.43	1544.19	1097.13	948.48	858.62	1251.77
Co-1	3.30	3.14	2.55	2.36	2.17	2.70	2380.63	2236.42	1767.17	1587.46	1414.40	1877.21
Rajendranthi	2.93	2.55	1.98	1.76	1.55	2.15	1999.02	1664.00	1251.33	1094.91	948.48	1391.55
Co-2	3.18	2.94	2.36	2.16	1.98	2.52	2267.48	2036.74	1586.35	1414.40	1250.22	1711.04
Mean	3.06	2.75	2.16	1.96	1.77	2.34	2130.81	1865.45	1423.27	1259.09	1113.33	1558.39
Factor	S.Em±			CD at 5% LOS			Factor	S.Em±			CD at 5% LOS	
Sowing date	0.12			0.33			Sowing date	51.75			147.69	
Variety	0.14			0.39			Variety	56.88			162.33	
Interaction	0.28			0.81			Interaction	82.10			234.32	

fenugreek; Seyyed *et al.* (2012) in coriander; Saddam *et al.* (2012) in fennel and Ahmad *et al.* (2011) in cumin.

Conclusion

Thus, it can be conclusively stated that the date of sowing as 15th October was found to be on par with 1st November and similarly 1st December and 15th December were also on par though recorded minimum values in respect of some of the characters including seed yield per plant and pod yield. Under the local conditions of coastal Andhra Pradesh the fenugreek cultivars *viz.*, Co-1 and Co-2 are found to be better as compared to other varieties like Hissar Sonali, Rajendranthi and Rmt-1 in the order. Maximum seed yield and pod yield was obtained by Co-1, which was on par with Co-2 sown on 15th October. Hence, these varieties can be preferred to sow fenugreek as sequence crop in *rabi* season. In case the season is delayed the negative effect on yield has also been quantified in respect of different parameters.

References

- Baswana, K. S. and M. L. Pandita (1989). Effect of time of sowing and row-spacing on seed yield of fenugreek. *Seed Research*, **17(2)** : 109-12.
- Batra, V. K., V. P. Mohan, K. K. Thakral and A. K. Bhatia (2002). Seed yield and quality of fennel as influenced by date of sowing and seed rate. *Haryana Journal of Horticultural Sciences*, **31(1/2)** : 111-13.
- Bhadkariya, S. K., K. B. S. Amit Gupta and L. S. Tomar (2007). Effect of different times of sowing on growth, yield and seed quality of coriander (*Coriandrum sativum* L.) cv. Cimpo S-33. *Bhartiya Krishi Anusandhan Patrika*, **22(3)** : 229-32.

Gill, B. S., G. S. Randhawa and S. S. Saini (2001). Effect of sowing dates and herb-cutting management on growth and yield of fenugreek (*Trigonella foenum-graecum*). *Indian Journal of Agronomy*, **46(2)** : 364-67.

Gowda, M. C., D. P. Halesh and A. A. Farooqi (2006). Effect of dates of sowing and spacing on growth of fenugreek (*Trigonella foenum-graecum* L.). *Biomed*, **1(2)** : 141-46.

Halesh, D. P., M. C. Gowda, A. A. Farooqi, M. Vasundhara and K. N. Srinivasappa (2000). Effects of dates of sowing and spacing on growth and yield in fenugreek (*Trigonella foenum-graecum* L.). *Spices and aromatic plants : challenges and opportunities in the new century*. Contributory papers. Centennial conference on spices and aromatic plants, Calicut, Kerala, India; **20-23** : 129-32.

Saddam, A. D., H. Adel, G. Abdel, A. Jawad, Al-Daiaeen, A. Haditha and Thalaen (2012). Effect of planting date and spacing on growth and yield of fennel (*Foeniculum vulgare* Mill.) under irrigated conditions. *Pakistan Journal of Biological Sciences*, **15(23)** : 1126-132.

Seyyed, G. (2012). Effects of sowing date and plant density on some traits of (*Coriandrum sativum* L.). *Technical Journal of Engineering and Applied Sciences*, **2(1)** : 11-16.

Sheoran, R. S., H. C. Sharma, P. K. Panuu and R. Niwas (2000). Influence of sowing time and phosphorus on phenology, thermal requirement and yield of fenugreek (*Trigonella foenum-graecum* L.) genotypes. *Journal of Spices and Aromatic Crops*, **9(1)** : 43-46.

Susil, T. and M. Rajkumar (2011). Effect of Date of Sowing of Ajowan (*Trachyspermum ammi* L.) Sprague on Seed Yield in Southern Telangana, Andhra Pradesh. *Madras Agricultural Journal*, **98(1-3)** : 39-40.