

Effect of time of sowing and last cut for fodder on phenology of Egyptian clover (*Trifolium alexandrinum*)

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Received: February 1998

ABSTRACT

In an experiment conducted with Egyptian clover (*Trifolium alexandrinum* L.), the time taken from sowing to attain different physiological phases (initiation, 50 and 100% flowering and seed maturity) decreased with delay in sowing from 1 October to 15 November and increased with delay in last cut for fodder from 20 February to 11 April. When the time to last fodder cutting was taken into consideration, the days taken to attain different phenophases progressively decreased with delay in last cut for fodder from February to April. The longest reproductive period and the maximum seed yield were registered in 15 November sowing. The longest reproductive phase and the maximum seed yield were also recorded in 12 March cutting date in 1992–93 and 2 March cutting date in 1993–94. The last fodder cutting taken on 11 April showed the shortest reproductive period and gave the lowest seed yield.

Key words : Phenological studies, Sowing time, Cut-off time, Egyptian clover, Seed yield

Besides genetic characters, yield potential of a crop also depends on the environmental conditions prevailing during its growth. The positive effect of environmental factors on growth and yield could be harnessed if the information on optimum time of sowing is made available. Time of sowing directly influences the fodder yield (Taneja *et al.*, 1987; Rana *et al.*, 1992) and indirectly affects seed yield of a fodder crop (Singh *et al.*, 1980) because seed yield is

also influenced by cutting management (Desai and Deore, 1983). Delay in last fodder cutting reduces the seed yield and quality (Tiwana and Bhullar, 1987; Saini and Chowdhury, 1993). Frequent cuttings for fodder result in low seed yield. For multicut forages like Egyptian clover, the knowledge about the time at which the last cut for fodder should be given importance to take maximum advantage of favourable environmental conditions prevailing during

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reproductive phases to produce maximum seed yield of good quality. However, no serious attempt has been made in the past to study the phenology of Egyptian clover under different times of sowing and last cut for fodder. Hence this investigation was carried out.

MATERIALS AND METHODS

The field experiment was conducted at the Research Farm of CCS Haryana Agricultural University, Hisar (29°10' N, 75° 46 E and 215.2 m above mean sea-level) during the winter (*rabi*) season of 1992–93 and 1993–94. Soil of the experimental field was sandy loam (Typic Ustochrept) with electrical conductivity of 0.99 dS/m, testing low in organic carbon (0.35%), and in available nitrogen (101.5 kg/ha) and medium in available phosphorus (16.8 kg P/ha).

The treatments were replicated thrice in split-plot design. The main plot treatments comprised 4 dates of sowing, viz. 1 and 15 October and 1 and 15 November, whereas 6 dates of last cut for fodder, viz 20 February, 2, 12 and 22 March, 1 and 11 April were assigned to the subplots. The plot size was kept as 6.0 m × 3.0 m Nitrogen (25 kg) in the form of urea and phosphorus (80 kg) in the form of single superphosphate/ha were drilled in soil before sowing. *Rhizobium trifolii*-inoculated seed of 'Mescavi' Egyptian clover was sown by broadcasting 30 kg seed/ha in about 5 cm standing water. All other recommended agronomic practices were adopted. The crop was harvested for green fodder at appropriate stages. The number of fodder cuttings obtained varied between 2 and 4 during

both the years, depending on date of sowing and last cut for fodder. The crop was left for seed setting after taking last fodder cutting as per treatments. The seed crop was harvested on 5 June in 1992–93 and on 21 May in 1993–94. The mean maximum temperature during the crop season was higher by 0.9°C while mean minimum temperature was lower by 0.3°C in 1993–94 compared to 1992–93. However, mean relative humidity (%) during the same period was higher (80.4/38.4) in 1992–93 compared to 1993–94 (77.0/30.2). Total of 50.4 and 31.8 mm rainfall was received during 1992–93 and 1993–94 crop season respectively.

RESULTS AND DISCUSSION

Crop duration after sowing

Time of sowing : Sowing time significantly influenced different phenological stages of Egyptian clover (Tables 1, Figs. 1, 2). Number of days taken for initiation, 50 and 100% flowering and crop maturity progressively decreased with delay in sowing time from 1 October to 15 November. The differences between successive dates of sowing for initiation, 50 and 100% flowering and maturity were significant.

Time of last cut for fodder : Time of last fodder cutting significantly influenced various phenophases during both the years (Table 1; Figs 1, 2). There was a consistent increase in number of days taken to attain different phenological stages with delay in last fodder cutting from 20 February to 11 April. Last cutting dates of 1 and 11 April took significantly more number of days for initiation of flowering in both years, 50%

Table 1. Number of days taken after sowing for initiation, 50 and 100% flowering and seed maturity as influenced by time of sowing and last cut for fodder

Treatment	Days taken to							
	Initiation of flowering		50% flowering		100% flowering		Maturity	
	1992-93	1993-94	1992-93	1993-94	1992-93	1993-94	1992-93	1993-94
<i>Date of sowing</i>								
1 October (D ₁)	191.2	186.2	204.4	198.4	211.8	206.6	222.3	215.3
15 October (D ₂)	183.3	179.3	196.9	192.3	204.2	199.9	216.2	204.7
1 November (D ₃)	162.4	155.9	173.9	168.3	181.6	175.9	194.8	182.5
15 November (D ₄)	148.3	147.9	159.7	161.4	168.5	167.2	183.2	177.8
CD (P = 0.05)	2.16	1.55	2.82	2.10	2.43	1.19	1.28	1.95
<i>Date of last cut for fodder</i>								
20 February (C ₁)	167.4	159.7	179.1	174.3	187.4	182.4	200.1	190.3
2 March (C ₂)	168.6	161.2	181.8	176.9	190.0	184.7	202.9	194.0
12 March (C ₃)	167.2	163.3	180.4	177.9	188.7	186.3	203.1	192.3
22 March (C ₄)	168.8	169.8	182.0	180.8	191.8	186.6	204.6	194.7
1 April (C ₅)	174.7	172.4	187.3	183.5	194.7	191.5	206.0	200.8
11 April (C ₆)	181.1	177.7	191.2	187.3	196.6	192.9	208.0	198.5
CD (P = 0.05)	3.35	1.86	3.90	2.82	3.10	2.17	3.30	2.90

Table 2. Number of days taken after the last cut for fodder for initiation of 50 and 100% flowering and seed maturity and seed yield of Egyptian clover as influenced by time of sowing and last cut for fodder

Treatment	Days taken to								Reproductive phase		Seed yield (kg/ha)	
	Initiation of flowering		50% flowering		100% flowering		Maturity		Y ₁	Y ₂	Y ₁	Y ₂
	Y ₁	Y ₂	Y ₁	Y ₂	Y ₁	Y ₂	Y ₁	Y ₂				
<i>Date of sowing</i>												
1 October (D ₁)	24.0	19.2	40.3	33.4	47.4	41.7	55.1	48.3	31.1	29.1	138	318
15 October (D ₂)	31.7	27.3	39.7	34.9	47.1	41.9	64.6	52.7	32.9	25.4	171	361
1 November (D ₃)	25.6	18.9	38.7	34.3	46.4	41.8	58.0	45.5	32.4	26.6	239	456
15 November (D ₄)	26.3	25.9	37.5	35.4	46.1	41.2	61.2	55.8	34.9	29.9	259	632
CD (P = 0.05)	2.10	1.86	NS	1.90	NS	NS	1.29	1.98			50	96
<i>Date of last cut for fodder</i>												
20 February (C ₁)	48.0	40.2	57.2	52.5	64.9	60.7	80.7	70.8	32.7	30.6	196	583
2 March (C ₂)	39.2	31.5	53.3	47.2	61.5	55.0	73.4	64.3	34.3	32.8	232	654
12 March (C ₃)	27.9	23.8	40.9	37.2	49.3	45.5	63.7	52.8	35.9	29.0	243	510
22 March (C ₄)	19.4	20.3	32.5	28.9	41.8	33.8	55.1	45.2	35.8	24.9	225	405
1 April (C ₅)	15.3	12.7	29.8	23.8	37.2	31.8	46.5	41.3	31.3	28.4	172	331
11 April (C ₆)	11.8	8.2	20.7	17.6	26.1	23.1	38.6	29.0	26.9	20.8	143	166
CD (P = 0.05)	3.27	1.49	3.90	2.70	3.03	2.19	3.31	2.90			30	68

Y, 1992-93; Y₂, 1993-94

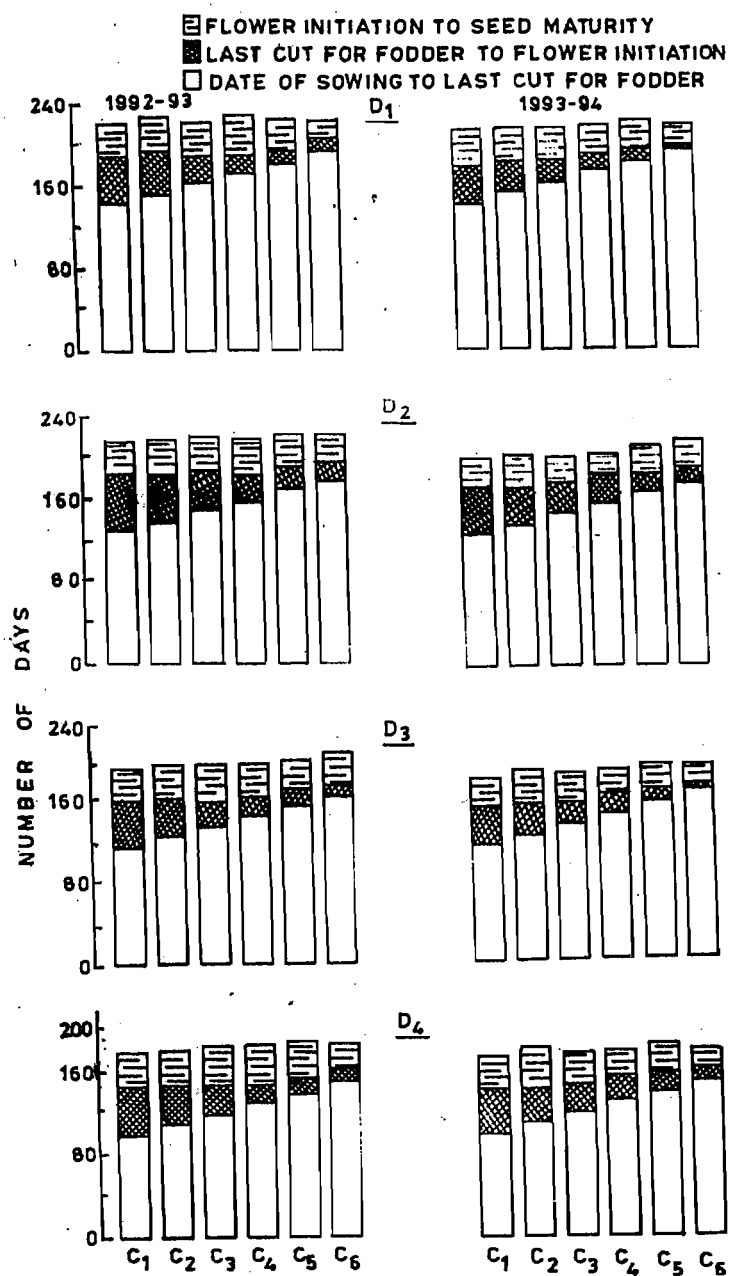


Fig. 1. Effect of sowing dates on vegetative and reproductive phases of Egyptian clover given last cut for fodder on different dates

flowering in 1992–93, 100% flowering and maturity in 1993–94 over last fodder cutting given on 20 February, 2, 12 and 22 March. Cutting date of 11 April took significantly more number of days for 50% flowering than all earlier cutting dates of last fodder in 1993–94, whereas similar increase in time taken for 100% flowering and seed maturity in 1992–93 was significant over last fodder cutting given up to 22 March. Differences in time taken for flowering initiation between successive cutting dates were also significant during 1993–94 except between 20 February and 2 March cutting dates.

Crop duration after last fodder Cutting

Time of sowing : There was no consistent trend for time taken to flowering and seed maturity under the influence of time of sowing (Table 2).

Reproductive phase (period from flower initiation to seed maturity) was the longest in 15 November sowing in both years and shortest in 1 October and 15 October sowings in 1992–93 and 1993–94 respectively (Table 2). Sowing of Egyptian clover on 15 November took significantly more days to maturity than all earlier dates of sowing in 1993–94. Similarly, 15 November sowing took significantly more number of days to maturity than 1 October and 1 November sowing in 1992–93 (Table 2). Seed yield was also maximum in 15 November sowings, whereas 1 October sowing resulted in the lowest seed yield. Thus the period available from flowering initiation to maturity had positive effect on seed yield. Seed yield was the maximum when the

crop was sown on 15 November. This might be due to the fact that its repeated cuttings for fodder (3–4) in earlier sowing dates caused more depletion of food reserves from source and consequently lesser amount of photosynthates might have been translocated to sink, i.e. seed, as compared to later sowing dates which were subjected to fewer fodder cuttings (2–3).

Time of last cut for fodder: Influence of last cut for fodder on different phases of Egyptian clover was significant (Table 2). The number of days taken to reach any particular phenophase progressively declined from 20 February to 11 April cutting dates in both years. The differences between successive cutting dates were significant except between 20 February and 2 March and also between 22 March and 1 April cutting dates for 50% flowering in 1992–93. Likewise, time taken for 100% flowering in 1993–94 was identical for 22 March and 1 April cutting dates. Duration of reproductive phase increased up to 12 March cutting date (35.9 days) in 1992–93 (Table 2). However, the longest reproductive phase (32.8 days) in 1993–94 was recorded in case of 2 March cutting date. Minimum number of days from flowering initiation to maturity in both years were taken by 11 April cutting date in both years. Seed yield followed the trends of reproductive phase.

Delay in the last cut for fodder significantly reduced the number of days taken to flower initiation and seed maturity. Higher seed yields in earlier cut-off dates for fodder (2–12 March) might be due to availability and subsequent translocation of more photosynthates to sink, i.e. seed, for

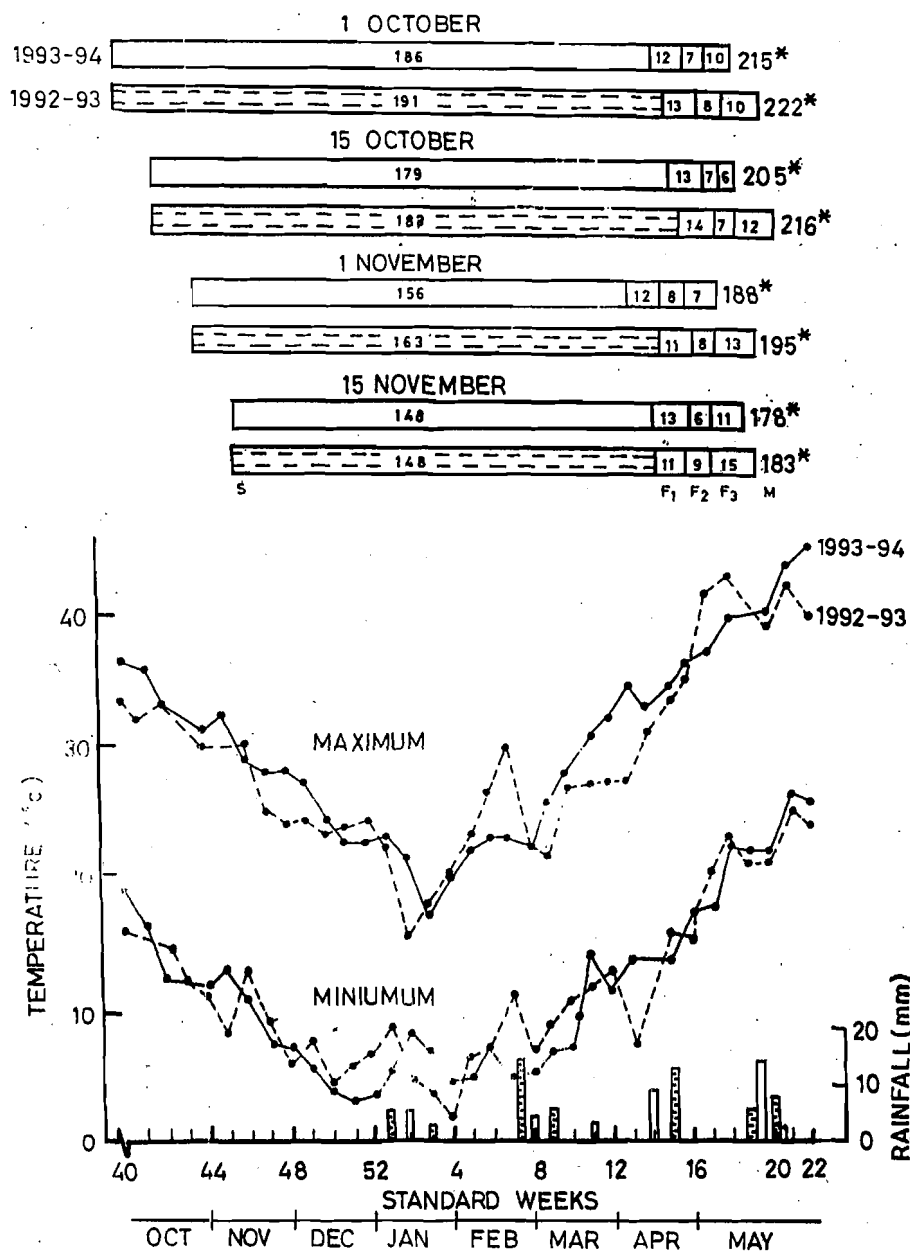


Fig. 2. Effect of temperature and rainfall on the phenology of Egyptian clover at various dates of sowing during the crop seasons (S, Date of sowing; F₁, flower initiation; F₂, 50% flowering; F₃, 100% flowering; M, maturity; * total crop duration in days)

longer period of time (Table 2). Dry climate during the reproductive phase of crop in 1993–94 though hastened maturity but was more conducive for seed setting (Fig. 2). Rainfall in 1992–93 (in April) coincided with flowering phase of Egyptian clover in 20 February and 2 March cutting dates of last fodder cutting. Similarly, in 1993–94, rains in May coincided with seed setting of 1–11 April cutting dates. Fewer fodder cuttings in 2–12 March cut-off dates (2–3) might have caused lesser depletion of photosynthates compared to 1 and 11 April cut-off dates which received 3–4 cuttings. Higher temperature at later stages (March–April) might have been beneficial for fast vegetative growth but adversely affected the regrowth where last fodder cutting was delayed. Rise in temperature in April–May might have adversely influenced the seed yield of Egyptian clover probably due to dessication of flowers, pollen abortion and seed setting in later cutting dates compared with the earlier dates of last fodder cutting. Dennis *et al.* (1959) observed that yield of multicut forages depended on cutting management; the frequent fodder cutting gave low seed yields. Singh and Nandkeolyer (1976) also opined that delay in last fodder cutting might lead to poor seed setting due to poor pollination in hot dry weather and a period of about 10 weeks between the last fodder cutting and seed maturity was required for successful seed setting.

The time of last cut for fodder had profound influence on various phenophases and seed yield of Egyptian clover. The number of fodder cuttings (as influenced by

both time of sowing and last cut for fodder) which determines the amount of photosynthates available, the period available for translocation of photosynthates to sink have marked influence on seed setting. Weather parameters play an important role in seed setting of Egyptian clover.

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