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Seed yield and quality of late-sown berseem (*Trifolium alexandrinum*) under different sowing dates and cutting management

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ABSTRACT

The pooled data of 1992–93 and 1993–94 revealed that 15 December sowing resulted in the maximum green-fodder and seed yields of berseem (*Trifolium alexandrinum* L.) which decreased with further delay in sowing. Sowing dates also significantly influenced the quality of seeds produced. The best-seed quality was obtained from 30 December sowing, while 30 January sowing gave the minimum fodder and seed yields with the poorest quality of seed. One cutting for fodder taken at 60 days after sowing resulted in the maximum seed yield, while maximum fodder yield was obtained from fodder cutting taken at 80 days after sowing. Time of fodder cutting did not have much influence on the quality of harvested seeds.

Key words : Berseem, Cutting time, Fodder and seed yields, Seed quality, Sowing time

Crop yield is influenced by inherent vigour of seed and environmental conditions prevailing during its growth. Since not much genetic improvement is possible in berseem due to little variation in its germplasm (Mehta and Swaminathan, 1965). Improvement in its productivity has to be achieved through manipulations in environmental factors. Careful selection of ideal sowing time to take maximum advantage of environmental conditions during growth of berseem may help in increasing its seed yield. Sufficient time is required after fodder cutting for optimum vegetative growth, attainment of bloom, pollination and seed setting. Quality of seed influences its emergence and field establishment (Kijashko, 1984; Powell *et al.*, 1984). Since information is not available on influence of optimum time of sowing and fodder cutting on the yield and quality of berseem meant for seed production, this investigation was undertaken.

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MATERIALS AND METHODS

A field investigation was conducted with 'Muscavi' berseem at Hisar (29°10' N, 75°46' E and 215.2 m above mean sea-level during winters of 1992–93 and 1993–94. Soil was sandy loam, low in available nitrogen, medium in available phosphorus and rich in available potassium. All the recommended agronomic practices except for sowing and cutting dates were followed. The treatments consisted of combinations of 4 dates of sowing (15 and 30 December and 15 and 30 January) and 4 dates of fodder cutting (uncut, cutting at 40, 60 and 80 days after sowing). Sowing dates in the main plots and cutting management in the subplots were replicated thrice in split-plot design. The gross plot size was 6 m × 3 m. After taking 1 fodder cutting as per treatments, the crop was left for seed setting, the crop was left for seed setting.

At maturity, 25 capsules/plot taken at random were hand-threshed. Total number of seeds in them were counted and averaged to seeds/capsule. A sample of 1,000 seeds was randomly collected from harvested produce plot-wise and test weight was recorded. The seed crop was harvested in the first week of June in 1993 and in the third week of May in 1994.

The seed quality was determined in laboratory bioassay. Final seed germination, root and shoot length, vigour index and dry weight of seedlings were determined 15 days after sowing (DAS) as per the ISTA methodology (ISTA, 1985). Seed nitrogen content was determined as per standard method. The data were analysed statistically.

RESULTS AND DISCUSSION

Fodder and seed yield

Sowing date : The sowing dates significantly influenced the fodder yield, seed yield attributes and seed yield (Table 1). Green fodder and seed yields decreased significantly with each delay in sowing time from 15 December to 30 January. All the sowing dates significantly differed among themselves for green-fodder yield. Consequently, the maximum green-fodder yield (mean of 2 years) registered in 15 December sowing was 14.6, 51.0 and 180.3% higher than that obtained from 30 December, 15 January and 30 January sowing respectively. The higher green-fodder yield in earlier sowing dates can be ascribed to more time available for vegetative growth and favourable environment for its growth during cool winter months. The 15 December-sown berseem got additional 45 days for its vegetative growth than 30 January sowing. Taneja *et al.* (1990) also reported similar results. Similar trend was observed for seed yield except for 15 January sowing where reduction in seed yield over 30 December sowing was non-significant. Sowing on 15 December resulted in 53.2, 61.4 and 329.7% higher mean seed yield than 30 December, 15 January and 30 January sowing respectively. The maximum reduction in seed yield attributes, green fodder and seed yields occurred between 15 January and 30 January sowing. Higher seed yield in earlier sowing dates could be attributed to more capsules/0.25 m^2 and seeds/capsule which decreased with each further delay in sowing. The 15 December-sown berseem got additional 45 days for its

Table 1. Effect of sowing dates and cutting management on green fodder, seed yield attributes and seed yield of late-sown berseem

Treatment	Capsules/ 0.25 m²			Seeds/ capsule			1,000-seed weight (g)			Green-fodder yield (q/ha)			Seed yield (q/ha)		
	Y_1	Y_2	Mean	Y_1	Y_2	Mean	Y_1	Y_2	Mean	Y_1	Y_2	Mean	Y_1	Y_2	Mean
Sowing date															
15 December	86.7	121.7	104.2	53.4	65.6	59.5	2.73	2.89	2.81	140.4	183.6	162.0	5.58	7.14	6.36
30 December	75.2	118.8	97.0	47.3	58.9	53.1	2.98	3.04	3.01	121.6	161.2	141.4	3.75	4.55	4.15
15 January	61.5	94.1	77.7	37.1	54.3	45.7	2.99	2.95	2.97	85.1	129.5	107.3	3.40	4.48	3.94
30 January	40.3	53.7	47.3	30.5	51.3	40.9	2.90	2.84	2.87	48.9	66.7	57.8	1.19	1.77	1.48
CD (P = 0.05)	7.9	11.4	9.8	3.8	3.1	3.3	0.12	0.11	0.14	15.6	28.4	17.2	0.45	0.68	0.55
Cutting management															
No cut	48.4	49.4	48.9	30.1	45.1	37.6	2.80	2.94	2.87				2.85	3.47	3.16
Cutting, 40 DAS	74.4	102.6	88.5	39.2	57.6	48.4	2.91	2.95	2.93	72.4	68.2	70.3	4.00	4.84	4.42
Cutting, 60 DAS	80.3	119.7	100.0	46.6	67.4	57.0	3.06	2.97	3.01	88.3	131.3	109.8	4.17	4.97	4.57
Cutting, 80 DAS	60.4	116.6	88.5	52.4	60.0	56.2	2.83	2.87	2.85	136.3	206.3	171.4	2.90	4.66	3.78
CD (P = 0.05)	8.1	10.9	11.5	4.2	2.6	2.0	0.08	NS	0.13	18.5	33.6	20.9	0.46	0.24	0.40

Y_1, 1992–93; Y_2, 1993–94

growth and seed development than 30 January sowing. However, 1,000-seed weight was maximum in 30 December sowing, followed by 15 January sowing. Taneja *et al.* (1991) corroborated similar findings and attributed this to poor germination, lesser seeds/capsule and test weight under delayed sowing conditions.

Cutting management: Time of berseem cutting for fodder also significantly influenced the green fodder and seed yields and its attributes (Table 1). Berseem cut for fodder at 80 days after sowing (DAS) resulted in the maximum green fodder which was significantly higher than remaining dates of fodder cutting. Mean increase in green fodder obtained at 80 DAS was 143.8 and 56.2% higher than that obtained from cutting given at 40 and 60 DAS. This increase was due to more time available for vegetative growth. Shaaban (1975) also reported higher green-fodder yield with delay in first fodder cutting.

The maximum mean seed yield (4.57 q/ha) was registered when berseem was cut for fodder at 60 DAS. It was significantly higher than berseem cut at 80 DAS and no-cut treatment. Berseem left for seed setting without taking any fodder cutting gave the lowest seed yield. For multicut forages like berseem, few fodder cuttings were necessary for better branching and increasing sink size for food reserves required for reporductive growth and seed setting (Singh, 1993). Lower seed yield with delayed fodder cutting before leaving it for seed setting might be due to poor regeneration owing to high temperature, shorter time span for vegetative and reproductive phases, coincidence of pollination and fertilization periods with sudden rise in temperature and consequently forced maturity of plants (Saini and Chowdhury, 1993).

Quality

Sowing date: Sowing dates significantly influenced various seed quality parameters except starch content in both the years and shoot length of seedlings in 1992–93 and seed protein content in 1993–94. The 30 December-sown berseem produced the seeds of best quality compared with the other sowing dates. These seeds recorded the maximum germination, root and shoot length, vigour index, dry weight of seedlings and total soluble sugars (Tables 2, 3). Since earlier-sown crop was also left for seed setting earlier after taking the fodder cutting at specified time than late-sown berseem, adequate vegetative growth and sufficient time available for seed setting in earlier sowing might have resulted in translocation of more photosynthates to seed during reproductive period. Brar (1981) also reported higher germination of seeds obtained from 3 January as compared to 2 February sowing.

Cutting management: Cutting management did not show much effect on different quality parameters (Tables 2, 3). However, root length of seedlings and vigour index in both years and seedling shoot length, seedling dry weight and seed protein content in 1993–94 differed significantly among different cutting treatments. The maximum root length of seedlings was obtained in cutting given at 40 DAS in both years, whereas vigour index was the highest in cutting given at 40

Table 2. Effect of sowing dates and cutting management on germination, root and shoot length and vigour index of late-sown berseem

Treatment	Germination (%)			Root length (mm)			Shoot length (mm)			Vigour index		
	Y_1	Y_2	Mean	Y_1	Y_2	Mean	Y_1	Y_2	Mean	Y_1	Y_2	Mean
Sowing dates												
15 December	93.7	96.7	95.2	6.19	6.85	6.52	3.77	3.95	3.86	997.4	979.0	988.2
30 December	97.4	99.2	98.3	6.98	7.28	7.13	4.03	4.27	4.15	1091.8	1125.8	1108.2
15 January	97.1	98.5	97.8	5.93	5.73	5,83	3.58	2.98	3.28	768.3	831.3	799.8
30 January	80.2	76.4	78.3	5.36	4.48	4.92	3.49	4.41	3.95	624.5	623.5	624.0
CD (P = 0.05)	4.0	6.8	6.2	2.34	3.12	1.48	NS	0.58	0.52	148.7	181.4	180.3
Cutting management												
No cut	90.4	93.6	92.0	6.02	6.18	6.10	3.14	4.32	3.86	825.1	845.3	835.2
Cutting, 40 DAS	91.9	88.7	90.3	6.56	6.36	6.46	3.83	4.05	3.94	987.6	751.2	869.4
Cutting, 60 DAS	93.3	95.3	94.3	6.26	5.46	5.86	3.96	4.20	4.08	946.3	919.3	932.8
Cutting, 80 DAS	92.8	93.2	93.0	5.62	6.28	5.95	3.68	3.04	3.36	723.0	1,043.8	883.4
CD (P = 0.05)	NS	NS	NS	0.64	0.71	NS	NS	0.76	NS	129.8	143.5	NS

Y_1, 1992–93; Y_2, 1993–94

Table 3. Effect of sowing dates and cutting management on the seed quality of late-sown berseem

Treatment	Seeding dry weight (mg)			Total soluble sugars			Starch content			Protein content (%)		
	Y_1	Y_2	Mean	Y_1	Y_2	Mean	Y_1	Y_2	Mean	Y_1	Y_2	Mean
Sowing date												
15 December	3.33	3.85	3.95	14.1	15.1	14.6	10.9	12.1	11.5	33.6	35.0	34.3
15 December	3.61	3.91	3.76	15.3	16.3	15.8	12.0	12.4	12.2	32.8	31.8	32.3
15 January	2.50	2.66	2.58	12.7	13.7	13.2	11.0	12.6	11.8	32.4	34.0	33.2
30 January	2.14	1.94	2.03	10.0	11.6	10.8	10.1	10.7	10.4	33.5	34.5	34.0
CD (P=0.05)	0.49	0.68	0.84	2.8	2.8	2.6	NS	NS	NS	Ns	2.6	1.1
Cutting management												
No cut	2.70	3.48	3.09	11.4	12.8	12.1	10.0	11.6	10.8	32.9	36.3	34.6
Cutting, 40 DAS	3.00	2.74	2.81	13.1	14.7	13.9	11.1	12.7	11.9	33.9	32.5	33.2
Cutting, 60 DAS	3.00	3.06	3.03	13.9	15.5	14.7	11.9	13.3	12.6	33.4	32.0	32.7
Cutting, 80 DAS	2.88	3.10	2.99	13.7	13.9	13.8	11.0	10.2	10.6	32.1	34.5	33.3
CD (P = 0.05)	NS	0.31	NS	NS	NS	NS	NS	NS	NS	NS	2.3	NS

DAS in 1992–93 and at 80 DAS in 1993–94. No-cut treatment registered significantly higher seed protein content than cutting given at 40 or 60 DAS in 1993–94. Similarly in 1993–94, no-cut treatment registered significantly highest seedling dry weight.

Thus delay in sowing beyond December adversely affected the seed yield and quality of berseem. While 15 December sowing gave the maximum fodder and seed yields, the seed quality was the best in 30 December-sown crop. Time of its cutting for fodder though did not show much influence on seed quality, the maximum seed yield was obtained when it was harvested for fodder 60 days after sowing.

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