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Effect of Agronomic Practices on Fresh Forage and Seed Yield of Barseem *Trifolium alexandrium L.*

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Abstract: Field trial on the effect of agronomic practices (sowing dates, sowing methods and harvesting frequencies) on fresh forage and seed yield of berseem was conducted at Students Farm, Sindh Agriculture University Tandojam. Results indicated that plant height, number of branches, fresh forage and seed yield were affected significantly by all the treatments as well as their interactions. Delay in sowing at 15 days interval from 1st November to 1st December depressed the fresh forage and seed yield, but seed yield was comparatively better in medium sowing, (15th Nov.) Seed broadcasted resulted in higher fresh forage and seed yield as compared to line sowing. Crop left after one cutting, progressively increased seed yield, but reduced the fresh forage yield, it was higher at 2nd cutting. It is suggested that for obtaining better fresh forage and seed yield, the seed should be broadcasted on 1st November to 15th November. The crop should be left for seed yield after one cutting. For fresh forage yield, number of cuttings may be increased.

Key Words: Brseem, Sowing Date, Sowing Method, Harvest Frequency, Forage, Seed, Yild

Introduction

Berseem (Egyptian clover) is an important winter forage crop of Pakistan, due to its precious role in the feeding of livestock. The production of fresh forage and seed yield of berseem can be increased by adopting proper agronomic practices, like date of sowing, method of sowing and frequency of cutting. Khan, *et al.* (1988), Ganguly and Relwani (1954), Masahibuddin and Hedayat (1965) reported that fresh forage and seed yield was significantly reduced by delaying crop sowing. As the number of cutting increased, the fresh forage yield decreased, while the seed yield was observed more from the plots of one cutting Anonymous, (1943). Anonymous (1962), Anonymous (1964a), observed that berseem left for seed setting after taking one cutting gave maximum seed yield than left after two or three cuttings. Gill (1965), Anonymous (1964b), Anonymous (1964c), Anonymous (1964d), obtained maximum seed and fresh forage yield of berseem from the crop sown in middle to end of October Shrestha, *et al*, (1993). They further observed that increase in the number of cuttings resulted in significantly increased fresh forage yield Westcott, *et al*, (1993). However, crop left after one cutting produced higher seed yield than four or five cuttings. Sulayman, *et al.* (1965) concluded that berseem crop could be planted successfully for seed and forage yields by broadcasting. Keeping the above facts in view an attempt was made to evaluate the effect of sowing dates, methods of sowing and frequency of cuttings on the fresh forage and seed yield of berseem under agro-ecological conditions of Tandojam Sindh.

Materials and Methods

To assess the influence of sowing dates, sowing methods and frequency of cuttings on berseem, an experiment was laid out at Students' Farm, Sindh Agriculture University Tandojam. *Rhizobium leguminosarum* treated seed of variety local was grown in sandy loam soil having pH 7.8, the mean, maximum and minimum air temperature during growth ranged from 64°F to 111°F and 35°F to 81°F. Four replicated split-split plot design, keeping main plots as sowing date (54x37.8m), sub plots as sowing method (18x12.6m) and subplots as harvest frequency (6x4.2m) were used. The details of the treatments are as under.

Main plots-sowing dates

1st November
15th November
1st December

Sub-plots-sowing methods

Broadcasting (In standing water)
Line Sowing at 30 cm apart (In water condition)
Line Sowing at 60 cm apart (In water condition)

Sub-sub-plots harvesting frequency

One cutting (left for seed)
Two cuttings (left for seed)
Three cuttings (left for seed)

The sowing was done in standing water at a seed rate of 25 kg^{-ha}. Subsequent irrigations were applied at 10 days interval for easy establishment of the crop. A basal dose of 50 kg N^{-ha} was applied after 1st cutting as Urea. Because the experimental soil was rich in available phosphorus and low in nitrogen percent (14.95 ppm and 0.022 % respectively).

The first cutting of each sowing was taken after six weeks of respective sowings and thereafter every 30 days intervals. For seed collection the crop was left from each sowing after one cutting, two cuttings and three cuttings. The following observations were recorded: plant height and number of branches were measured after random selected 10 plants from each treatment at every cutting. Fresh forage yield was recorded at the time of each cutting. Seed yield was recorded after taking different cuttings, (treatment were left for seed), threshed by the help of sticks. The fresh forage and seed yield obtained from sub-sub plots were calculated for per hectare.

All the collected data were subjected to analysis of variance. To discriminate the superiority of treatment means L.S.D. test was applied, following Gomez and Gomez (1984).

Results and Discussion

Significant effect ($P<0.01$) of sowing dates was observed

for plant height. For the significantly affected variable 1st December or 1st November sowings generally resulted in taller plants. Medium (15th Nov.) sowings produced dwarf plants. It might be due to fluctuation in air temperature (Table 1). Method of sowing significantly affected (P< 0.01) plant height. Broadcast method of sowing produced maximum plant height, whereas line sowing displayed lowest plant height (Table 1). The influence of harvest frequency was also significant statistically (P< 0.01). Plant height measured at the time of second cutting was taller to those recorded at 1st or 3rd cuttings (Table 1).

The sowing date and method (SXM) interaction was significant (P<0.01) for plant height. Maximum plant height was exhibited at 1st November sowing date with broadcast method of sowing which was significantly at par with 15th November sowing date under line sowing (60 cm apart rows) (Table 2). Sowing method x harvest frequency interaction (M x F) affected the plant height (P<0.05), seeds broadcasted and left after one cutting gave taller plants over line sowing crop with three cuttings (Table 2). The height of berseem plants were appreciably affected by sowing dates x harvest frequency interaction (SxF). Seed sown on 15th November and harvested once had taller plants as compared to late sown crop in rows 30 cm apart, which was significantly lowest (Table 2). The detailed analysis of the nature and magnitude of the sowing date x method x harvest frequency (SxMxF) interaction depicted that seed broadcasted during 1st November and harvested twice resulted in significantly superior (P<0.05) plant height over that of crop sown at 60 cm apart rows and harvested three times.

The influence of sowing date on number of branches was statistically significant (P<0.01). Delay in planting reduced the number of branches per plant, whereas medium date of 15th Nov., recorded maximum branches/plant, followed by early sowing of 1st November (Table 1). The number of branches per plant varied significantly (P<0.05) due to change in sowing method. Seed sown in rows spaced at 60 cm produced maximum branches per plant, followed by 30 cm rows apart. However, seed broadcasting resulted in lowest number of branches per plant (Table 1). The harvest frequency had highly significant influence on number of branches / plant. The branches / plant recorded at 2nd cutting were higher than recorded at 1st and 3rd cuttings.

The effect of sowing date x method (SxM) interaction was significant (P < 0.05). Seed sown in rows 60 cm apart during 15th November gave maximum number of branches/plant. Seed drilled in rows 30 cm apart during 1st December produced lowest branches/plant (Table 3). The interaction of sowing method x harvest frequency (SxF) was significantly different in producing the number of branches per plant. Seed drilled at 30 cm apart and harvested thrice recorded higher number of branches/plant over wider row spacings of 60 cm with two cuttings (Table 3). It was further observed that the sowing date x harvest frequency (SxF) interaction had significant effect (P<0.01) on number of branches/plant. Crop sown on 15th November and harvested twice significantly improved the number of branches, over late seeded (1st December) crop with three cutting (Table 3). The detailed analysis (SxMxF) depicted that number of

Table 1: Mean yield components, green fodder and seed yield of berseem as affected by different cultural practices

Characters	Plant Height (cm)	Branches/ Plant	Green Fodder Yield/ha (m.t)	Seed Yield/ha (Kg)
Sowing dates				
1st Nov.	64.04	6.75	19.72	95.25
15th Nov.	53.80	7.16	17.91	116.71
1st Dec.	61.59	5.04	15.92	44.42
L.S.D.P<0.05	3.29	0.69	1.20	20.00
L.S.D.P<0.01	4.98	1.05	2.72	31.25
Sowing Methods				
Broadcasting	62.38	6.09	20.09	99.77
Line Sowing (30 cm)	58.06	6.29	17.54	80.19
Line Sowing (60 cm)	55.01	6.58	15.20	76.42
L.S.D. P<0.05	4.45	0.49	1.29	2.03
L.S.D. P< 0.01	6.11	-	1.77	8.66
Harvest Frequency				
Left for seed after one cutting	55.71	6.59	18.82	143.06
Left for seed after two cutting	72.33	7.46	22.41	107.29
Left for seed after 3 cuttings	47.36	4.92	12.32	6.70
L.S.D. P<0.05	4.12	0.34	0.98	22.58
L.S.D. P<0.01	5.50	0.43	1.30	30.12

Table 2: Interaction effects (Sowing Dates x Sowing Methods), (Sowing Methods x Harvest Frequency), (Sowing Dates x Harvest Frequency) on plant height

Sowing dates x Methods

Sowing Methods	Sowing Dates		
	1st Nov.	15th Nov.	1st Dec.
Broadcasting	66.07	54.48	62.52
Line sowing (30cm) apart	56.12	56.97	61.10
Line sowing (60 cm) apart	97.95	45.95	61.15
L.S.D. at P<0.05	7.75		
L.S.D. at P<0.01	10.63		

Sowing Methods x Harvest Frequency

Sowing Methods	Harvest Frequency		
	1st cut	2nd cut	3rd cut
Broadcasting	62.12	73.40	51.55
Line sowing (30cm) apart	53.00	71.83	45.35
Line sowing (60 cm) apart	48.02	71.77	45.27
L.S.D. at P<0.05	2.51		

Sowing dates x Harvest frequency

Sowing Methods	Sowing Dates		
	1st Nov.	15th Nov.	1st Dec.
1st cutting	57.85	81.20	41.08
2nd cutting	48.30	70.05	43.05
3rd cutting	60.98	65.75	58.03
L.S.D. at P<0.05	7.13		
L.S.D. at P<0.01	9.51		

branches were changed significantly (P<0.05) due to different agronomic practices. Seed sown in rows 30 cm apart during 15th November and harvested thrice resulted in greater number of branches/plant, over wider row spacing of 60 cm in delayed (1st December)

Table 3: Interaction effects (Sowing Dates x Sowing Methods), (Sowing Methods x Harvest Frequency), (Sowing Datesx Harvest Frequency) on number of branches/plant

Sowing dates x Methods

Sowing Methods	Sowing Dates		
	1st Nov.	15th Nov.	1st Dec.
Broadcasting	6.77	7.25	4.95
Line sowing (30cm) apart	6.52	6.81	4.94
Line sowing (60 cm) apart	6.98	7.43	5.33
L.S.D. at P<0.05	0.85		

Sowing Methods x Harvest Frequency

Sowing Methods	Harvest Frequency		
	1st cut	2nd cut	3rd cut
Broadcasting	6.70	6.24	6.83
Line sowing (30cm) apart	7.23	7.21	7.93
Line sowing (60 cm) apart	4.96	4.82	4.98
L.S.D. at P<0.05	0.20		

Sowing dates x Harvest frequency

Sowing Methods	Sowing Dates		
	1st Nov.	15th Nov.	1st Dec.
1st cutting	7.02	7.08	5.67
2nd cutting	7.32	8.05	7.00
3rd cutting	5.93	6.35	2.47
L.S.D. at P< 0.05	0.57		
L.S.D. at P< 0.01	0.76		

Table 4: Interaction effects (Sowing Dates x Sowing Methods), (Sowing Methods x Harvest Frequency), (Sowing Datesx Harvest Frequency) on green fodder yield/ha (M.T)

Sowing dates x Methods

Sowing Methods	Sowing Dates		
	1st Nov.	15th Nov.	1st Dec.
Broadcasting	23.44	19.83	19.09
Line sowing (30cm) apart	19.35	17.15	16.15
Line sowing (60 cm) apart	16.33	16.73	12.51
L.S.D. at P<0.05	0.75		

Sowing Methods x Harvest Frequency

Sowing Methods	Harvest Frequency		
	1st cut	2nd cut	3rd cut
Broadcasting	22.74	25.15	14.50
Line sowing (30cm) apart	18.39	21.96	12.30
Line sowing (60 cm) apart	15.32	20.10	10.17
L.S.D. at P<0.05	0.60		

Sowing dates x Harvest frequency

Sowing Methods	Sowing Dates		
	1st Nov.	15th Nov.	1st Dec.
1st cutting	19.68	17.41	19.36
2nd cutting	23.84	22.44	13.89
3rd cutting	19.36	20.94	07.45
L.S.D. at P< 0.05	1.70		
L.S.D. at P< 0.01	2.26		

sowing and harvested thrice.

Mean fresh forage yield per hectare varied significant differences (P<0.01) due to change in sowing dates. Each successive delay in sowing from 1st November suppressed the fresh forage yield. Similar results have been reported by Khan *et al.* (1988), Ganguly and Relwani (1954), Masahibuddin and Hadayat (1965) and Shrestha, et al. (1993). The usual table further showed that the sowing method significantly exhibited (P<0.01) towards fresh forage yield ha^{-1}. Seed broadcasted resulted in higher fresh forage yield which was significantly at par with line sowing at 30 or 60 cm apart rows respectivly. These results are in accordance with the findings of Sulayman, et al. (1965). It was observed that fresh forage yield was significantly different (P<0.01) due to various harvest frequencies. The yield of fresh forage when recorded at 2nd cutting was superior to those obtained at the time of 1st or 3rd cutting. These results are in agreement with the results obtained by Gill (1965), Anonymous (1964a, 1964b, and 1964c) and Westcott, *et al.* (1993).

The effect of sowing date x method (SxM) interactions was significantly different (P<0.05) in fresh forage yield. Crop broadcasted during 1st November resulted in maximum fresh forage yield which was significantly better than crop raised in lines 30 and 60 cm apart during 1st December (Table 4). Sowing method x harvest frequency (SxF) interaction was also statistically significant (P<0.05). Seed broadcasted and crop harvested twice recorded significantly higher fresh forage yield which was significantly superior to those obtained from seed sown in wider spacing of row 60 cm apart and harvested thrice (Table 4). The detailed analysis for sowing date x sowing method x harvesting frequency (SxMxF) displayed significantly different trends for seed yield. Seed broadcasted on 1st November and harvested twice resulted in significantly higher fresh forage yield over late sown crop in wider inter row spacing of 60 cm and harvested thrice.

Table 1 indicated that mean seed yield of berseem varied significantly (P<0.01) due to different sowing dates. November 15th sown crop gave higher seed yield followed by 1st November, whereas later planted (1st December) crop displayed minimum seed yield. Similar results have been reported by Khan (1988), Ganguly and Relwani (1954), Masahibuddin and Hadayat (1965). Sowing method also had pronounced effect (P<0.05) on seed yield. Seed broadcasted resulted in higher seed yield which was significantly superior to line sowing at 30 or 60 cm apart rows. These results are in agreement with those of Sulayman *et al.* (1965). Harvest frequency was significant in seed yield (P<0.01). Crop left for seed after one cutting produced maximum seed yield, followed by 2 cuttings, however, crop left for seed after three cuttings significantly reduced seed yield. These results contracts with the findings of Anonymous (1943), Anonymous (1962), and Anonymous (1964a).

The interaction of sowings date x method (SxM) was significant (P<0.05), seed broadcasted during 15th November gave significantly greater seed yield than seed sown in rows 30 cm apart, during December (Table 5). The effect of sowing method x harvest frequency (MxF) interaction was also significant (P<0.05). Seed broadcasted and harvested one time produced higher seed yield which was significantly superior to those

obtained from seed sown in rows 30 or 60 cm apart and left for seed after 3rd cutting (Table 5). Sowing dated x

Table 5: Interaction effects (Sowing Dates x Sowing Methods), (Sowing Methods x Harvest Frequency), (Sowing Dates x Harvest Frequency) on seed yield/ha (kg)

Sowing dates x Methods

Sowing Methods	Sowing Dates		
	1st Nov.	15th Nov.	1st Dec.
Broadcasting	120.47	151.72	35.01
Line sowing (30cm) apart	85.72	114.07	37.65
Line sowing (60 cm) apart	83.95	83.95	61.36
L.S.D. at P<0.05 15.06			

Sowing Methods x Harvest Frequency

Sowing Methods	Harvest Frequency		
	1st cut	2nd cut	3rd cut
Broadcasting	181.84	109.18	8.66
Line sowing (30cm) apart	131.01	101.65	5.65
Line sowing (60 cm) apart	114.82	109.18	5.65
L.S.D. at P<0.05 13.18			

Sowing dates x Harvest frequency

Sowing Methods	Sowing Dates		
	1st Nov.	15th Nov.	1st Dec.
1st cutting	167.53	193.13	67.01
2nd cutting	105.41	149.13	65.13
3rd cutting	12.42	5.65	1.88
L.S.D. at P< 0.05 38.78			
L.S.D. at P< 0.01 51.95			

harvest frequency (SxF) interaction was also statistically significant (P<0.01) for seed yield. Crop sown on 15th November and harvested once gave maximum seed yield and it was followed by crop sown on 1st Nov. and harvested once. The lowest seed yield was obtained when the crop was planted on 1st December and cut for three times (Table 5). The detailed analysis of sowing date x sowing method x harvest frequency (SxMxF) interaction revealed that seed broadcasted during 1st November and left after one cutting gave maximum seed yield which was significantly superior to wider inter row spacing of 60 cm in later sowing date (1st December) and left for seed after three cuttings.

Conclusion

It may be concluded that berseem planted on November, 1st and November, 15th displayed maximum fresh forage and seed yield. Seed broadcast method of sowing also recorded greater fresh forage and seed yield over line sowing of 30 or 60 cm apart. It was further found that berseem harvested twice and left for seed resulted in greater fresh forage yield, whereas berseem left for seed after one cutting gave significantly higher seed yield.

It was suggested that for obtaining better fresh forage yield, berseem may be sown on November 1st using seed broadcasting method of sowing and harvested twice. However for better seed yield, the seed may be broadcasted on November 15th and left for seed after one cutting.

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