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Effect of Date of Sowing and Cutting Management on Seed Yield in Berseem (*Trifolium alexandrinum* L.)

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ABSTRACT

Berseem is an important *rabi* fodder crop for dairy animals as it helps to maintain the availability of green fodder from month of October to April in addition to its easy digestibility and high nutrient content. The field was laid out in split plot design with fifteen treatments and three replications. Five dates of sowing *i.e.,* D_1:5 November, D_2:15 November, D_3:25 November, D_4:5 December and D_5: 15 December comprised main plots, whereas sub plot treatment consisted of three last cutting dates C_1:5 April, C_2: 15 April and C_3: 25 April. The later sown crop (15th December) gave the highest seed yield (4.69 q/ha), which was statistically similar to 5th December sowing (D_4). In case of last cutting date, treatment C_1 recorded the highest seed yield of 5.08 q/ha which was followed by C_2 (4.28 q/ha) and C_3 (3.83q/ha).

Key Words: Berseem, Fodder, Crop and Seed yield.

INTRODUCTION

Berseem (*Trifolium alexandrium* L.) is an important *rabi* fodder crop for dairy animals in India, as it helps to maintain the availability of green fodder from month of October to April besides its easy digestibility and high nutrient content. It contains 18 to 21 per cent protein, 1.98 per cent calcium and 0.64 per cent phosphorus. It is grown on 1900 thousand hectares and gave green fodder productivity of 60 to 110 t/ha (Anonymous, 2017 a). It is very prominently grown in Punjab state over 2.24 lakh ha with production of 213.3 lakh tones and fodder yield of 95.1 t/ha (Anonymous.2017 b).

In Punjab, the availability of green fodder supply is quite low (29.8 kg/animal/day) as compare to recommended supply of green fodder (40 kg green fodder/adult animal/day).As per future projection of fodder are very high *i.e.,* 911 lakh tones of fodder will be required to meet the green fodder requirement to animals. To achieve this there is need to increase area and production per unit land per unit time by adopting better agronomic practices. Among the agronomic practices, optimum dates of sowing and cutting management are the important practices for realizing higher productivity of berseem. Crop yield is influenced by genetic and environmental factors. Due to little variation in germ-plasm of berseem, there is emerge scope of genetic improvement in this crop. However, there is ample scope for enhancing productivity of berseem by tailoring various pheno-phases of crop with the optimum environment conditions. This can be achieved by selecting appropriate sowing time for fodder crop and then leaving the crop for seed purpose at appropriate time.

Careful selection of ideal sowing time to take maximum advantage of environmental conditions during growth of berseem may help in increasing seed yield. Sufficient time is required after fodder cutting for optimum vegetative growth, attainment of bloom, pollination and seed setting. The late sown berseem may greatly improve upon the existing poor supply of its seed in the state and can also help to improve the availability of green fodder during April-May, a scarcity period for green fodder and leguminous crop and it further helps in building the soil fertility.

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The time of last fodder cut after which crop should be left for seed production is another crucial factor for enhancing green fodder yield and seed productivity. Under Punjab conditions seed production of berseem is also low due to the fact that farmers pay less attention to seed production, thereby causing serious seed shortage of quality seed. Farmers continue fodder cutting till late March to mid-April, which results in low foliage retention, poor flowering and finally low seed production. Reduced viability of pollen grains due to high temperature and low relative humidity at the reproductive stage are the major factors responsible for low seed yield of berseem (El-nably *et al*, 2012). Further clover seed production also depends upon conditions such as temperature and relative humidity prevailing during the reproductive phase (Bakhei *et al*, 2012).The seed yield could be enhanced through proper cutting management at the last forage cut. High temperature during flowering stage, stimulates respiration and reducing photosynthesis (Hayat *et al*, 2009). The last cut for fodder should be timed in such a way that blooming and seed development stages coincide with the favourable weather conditions which may be decided by manipulation of suitable date of sowing and last cut management. Keeping the above view in consideration, the present study entitled Effect of date of sowing and cutting management on seed yield in berseem (*Trifolium alexandrinum L.*) was conducted.

MATERIALS AND METHODS

The experiment was laid out in split plot design with fifteen treatments and three replications. Five dates of sowing i.e. D_1:5 November, D_2:15 November, D_3:25 November, D_4:5 December and D_5:15 December comprised main plots, whereas sub plot treatment consisted of three last cutting dates C_1:5 April, C_2:15 April and C_3: 25 April. The soil of the experimental field was sandy loam in texture with normal pH (7.82) and electrical conductivity (0.26).Soil rated medium in organic carbon (0.47), low in available nitrogen (203.70) and medium in available phosphorus (18.23) and potassium (295.50). The preparation of the experimental field was done by following local package and practices. Various observations recorded were as days taken to 50 and 100 percent flowering after last cut, number of days taken for seed setting and maturity, Number of heads per tiller, number of seeds /head, number of tillers/plant, test weight and seed yield. Data were analysed statistically as per Snedecor and Cochran (2001)

RESULT AND DISCUSSION

Days to 50 percent flowering after last cut

The data on days to 50 per cent flowering presented (Table1) revealed that late sown crop (December 15) took the highest number of days (25.7) to reach 50% flowering stage. However the difference among different sowing dates was non-significant. In case of last cut treatments, C_1 (34.8) took significantly more number of days for 50% flowering than C_2 (24.7) and C_3 (13.8). The lowest number of days to 50 per cent flowering in C_3 might be due to more number of cuttings that leads to low regeneration potential. The results were in agreement with the findings of Srivastava (2015). All interactions were found to be non significant.

Days taken to 100 percent flowering after last cut

The data (Table 1) indicated that date of sowing did not affected number of days taken to 100 per cent flowering. However, date of last cut had significant effect on days taken to 100 per cent flowering after last cut. The highest number of days to reach 100% were noted under the treatment C_1 (44.8) followed by C_2 (31.1) and C_3 (22.4). All these treatments were significantly varied with each other. The lowest number of days taken to maturity after last cut in C_3 might be due to span of reproductive phase was decreased with increase in photo and thermo period. Similar results are reported Yadav *et al* (2015). All interactions were found to be non significant.

Table 1. Effect of date of sowing and cutting management on growth and yield parameters of late sown berseem (*Trifolium alexandrinum* L.)".

Treatment	Days taken to 50% flowering After last cut	Days taken to 100% flowering after last cut	Days taken to maturity After last cut	No. of Heads/ tiller	No. of seeds / head	Test weight	Number of tillers / plant at harvest	Seed yield (q/ha)
Sowing dates								
5th November	24.2	33.0	66.0	3.16	35.2	2.99	4.21	4.07
15th November	23.9	32.5	64.8	3.31	37.2	3.08	4.89	4.22
25th November	24.9	32.9	64.2	3.41	40.0	3.14	5.23	4.39
5th December	23.3	32.8	63.0	3.56	42.4	3.28	5.52	4.61
15th December	25.7	32.7	61.8	3.72	45.0	3.32	5.85	4.69
CD(p=0.05)	NS	NS	NS	0.20	3.32	NS	0.27	0.30
Date of last cut								
5th April	34.8	44.8	70.6	3.73	42.5	3.24	5.83	5.08
15th April	24.7	31.1	63.6	3.46	40.4	3.15	5.05	4.28
25th April	13.8	22.4	57.7	3.11	37.2	3.10	4.48	3.83
CD(P ≤0.05)	1.94	1.61	5.1	0.17	1.96	NS	0.16	0.26

Days taken to maturity after last cut

The data (Table 1) indicated that date of sowing did not affected number of days taken to maturity flowering. The date of last cut showed significant effect on days taken to maturity. The highest number of days to reach maturity was observed in C_1 (70.6), which was significantly higher than C_2 (63.6) and C_1 (57.7). The lowest number of days taken to maturity after last cut in C_3 might be due to span of reproductive phase was decreased with increase in photo and thermo period. Yadav *et al* (2015) also reported similar results. All interactions were found to be non significant.

Number of heads per tiller

Number of heads per tiller varied significantly under the influence of date of sowing. Delay in sowing from November 5 to December 15 through November 15, November 25 and December 5, resulted in consistent decrease in number of heads per tiller but difference between the consecutive sowing dates were not significant. The lesser number of heads per tiller under early sowing date may be associated with preliminary weather. The last cutting date treatments had significant effect on number of heads per tiller. Among last cutting dates, C_1 had maximum value of 3.73 which was significantly higher than C_2 (3.46) and C_3 (3.11). The decrease in number of heads per tiller might be due to increased temperature that reduced pollen fertility resulting in reduced seed set. The results were in conformity with the findings of Yadav *et al* (2015). All interactions were found to be non significant.

Number of seeds per head

The date of sowing had significant effect on number of seeds per head and presented in

Table 1. The highest number of seeds per head were observed under D_5 (45.0) followed by D_4 (42.4), D_3 (40.0), D_2 (37.2) and D_1 (35.2). D_5 (45.0) and D_4 (42.4) were at par with each other but significantly better than D_3 (40.0), D_2 (37.2) and D_1 (35.2). Increase in number of seeds per head with delayed sowing was in conformity with the findings of Srivastava (2016). The date of last foliage cut affect number of seeds per head and maximum number of seeds per head was recorded under C_1 (42.5), C_2 (40.4) and C_3 (37.2) where C_1, C_2 and C_3 were significantly differ from each other. The reduction in number of seeds per head in treatment C_3 due to inadequate transport of photosynthates to developing berseem seeds and also due to the increasing atmospheric temperature at the last foliage cut. The data were in conformity with the findings of Srivastava (2016). All interactions were found to be non significant.

Test weight (g)

The data (Table 1) showed that test weight did not varied significantly with date of sowings. The maximum test weight was recorded under D_5 having value of 3.32 followed by D_4, D_3, D_2, D_1 having test weight of 3.28, 3.14, 3.08, 2.99 g respectively. Similarly, last foliage cut had non-significant effect on test weight where maximum test weight was recorded with C_1 (3.24) and minimum was recorded with C_3 (3.10). All interactions were found to be non significant.

Number of tillers per plant at harvest

The perusal of data (Table 1) showed that date of sowing had significant effect on number of tillers per plant at harvest. The highest number of tillers were recorded under last sowing date i.e. D_5 (5.85) followed by D_4 (5.52), D_3 (5.23), D_2 (4.89) whereas minimum value was found in D_1 (4.21). Because of more number of cuttings in early sowings, the regeneration potential of plants might have been adversely affected which caused the number of tillers per plant at harvest to remain low. Similar results were reported by Mahar *et al* (2017). Among the date of last cut C_3 had highest value of 5.83, whereas C_2 and C_1 had values 5.05 and 4.48. However, all these treatments varied significantly with each other. The decrease in number of tillers / plant at harvest in last cutting date C_3 might be due to an increase in temperature at this date.

Seed yield (q/ha)

The perusal of data (Table 1) revealed that date of sowing had significant effect on seed yield. The later sown crop (15th December) gave the highest seed yield (4.69 q/ha), which was statistically similar to 5th December sowing (D_4). Likewise seed yield D_3 with D_4 but significantly lower than D_5. Sowing the crop on November 5 gave the least seed yield that was similar to 15th November sowing but 25th November sowing out yield the earliest sown crop. The results were in conformity with the finding of Din *et al*, (2014). In case of last cutting date, treatment C_1 recorded the highest seed yield of 5.08 q/ha which was followed by C_2 (4.28 q/ha) and C_3 (3.83q/ha). It was found that all the treatments varied significantly amongst each other. The higher seed yield might be the reason of fewer fodder cuttings that resulted in more translocation of photosynthates to seed. The present data is in conformity with the findings of Kumar and Patel (2017). All interactions were found to be non significant.

CONCLUSION

From the results of this experiment it may be inferred that depending upon the growing resources, cropping system adopted and interests of farmers, the sowing and last cut dates of berseem can be manipulated. For instance, a grower interested mainly in seed production should sow the crop on first week of December. Similarly, for higher seed yield the last cutting should be taken at an early date *i.e.* first week of April.

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