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Influence of Date of Sowing and Cultivars on Growth and Yield of Fodder Oats (*Avena sativa* L.) in New Alluvial Zone of West Bengal

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Abstract A field experiment was conducted during *rabi* season of 2007-2008 and 2008-2009 to study the influence of date of sowing and variety on growth and yield of fodder oats. The experiment, consisting of 18 treatment combinations having three levels of date of sowing (15th Nov 30 Nov and 15th Dec) and six levels of variety (NDO-1, Kent, JHO-822, OS-6, UPO-212 and JHO-851) was laid out in factorial randomized block design (FRBD) where each treatment was replicated thrice. Various growth attributes (viz. Plant height, number of tillers per plant, leaf area index and dry matter accumulation) and yield attributes (viz. green fodder, dry fodder and crude protein yield) of fodder oats were influenced significantly with different dates of sowing and variety. At 75 DAS oat cv OS-6 recorded maximum plant height (123.85 cm), which was significantly higher than all other varieties. The maximum dry matter accumulation (313.48 g m^{-2}) of oat was recorded when sown at 15th Nov. The maximum dry matter was recorded in cv OS-6 (378.46 g m^{-2}) which was significantly greater than that of all other varieties. Significantly highest GFY (353.81 q ha^{-1}) was recorded when sown 15th Nov. The maximum crude protein yield (6.60 q ha^{-1}) was recorded in cv OS-6. A significant response from date of sowing and variety was found on total green and dry fodder yields of oats and crude protein yield.

Keywords Sowing date, Variety/cultivar, Growth, Fodder yield, Crude protein.

Introduction

Oats (*Avena sativa* L.) is an important winter cereal forage crop over the world. It is becoming a promising good quality forage crop due to its excellent growth habit, better regeneration capacity, palatability and nutritive value. It contains 3.32-6.90% protein, 30-35% dry matter, 9.33% total ash, 0.47% calcium, 0.22% phosphorus and 2.43-4.38% potassium. It is used as green fodder, straw, hay or silage. Fodder is the major input in livestock production. In value terms, it accounts for about 80-90% of the variable cost of milk production. The feed and fodder in In-

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dia mostly consists of crop by-residues that depend on the regional cropping pattern. Two essential sources of nutrients to realize the genetic potential of animals, viz., green fodder and concentrates, particularly in the form of balanced compound animal feed are in short supply. The date of sowing is the vital task for higher yield because its growth depends on cool season duration. Three dates of sowing were initiated with six different varieties to get a optimum fodder yield as well as fodder protein quality. Besides this, two things were very clear from this experiment, one is date of sowing which date is optimum for higher green fodder yield and good varietal performance among all the genotypes in new alluvial zone of West Bengal. With this background, the experiment was taken upto study the influence of date of sowing and variety on growth and yield of fodder oats.

Materials and Methods

The experiment was carried out during winter season of 2007-2008 and 2008-2009 at Central Research Farm, Gayeshpur, Bidhan Chandra Krishi Viswavidyalaya, Nadia, West Bengal, situated at 23°39′ N latitude and 89°42′ E longitude with an average attitude of 9.75 m above mean sea level to study the influence of date of sowing and variety on growth and yield of fodder oats in new alluvial zone of west Bengal. The experimental soil was sandy loam in texture with neutral in reaction (pH 6.9), low in available nitrogen (167.5 kg ha^{-1}), medium in available phosphorus (45 kg ha^{-1}) and medium in available (240 kg ha^{-1}). The experiment, consisting of 18 treatment combinations having three levels of date of sowing (15th Nov, 30 Nov, and 15th Dec) and six levels of variety (NDO-1, Kent, JHO-822, OS-6 UPO-212 and JHO-851) was laid out in factorial randomized block design (FRBD) where each treatment was replicated thrice. The experiment was repeated in 2013-2014 with same treatment combinations. The N, P_2O_5 and K_2O fertilizers were applied @ 90: 60 : 60 kg/ha. Half dose of nitrogen (urea) and full quantity of phosphorus (SSP) and potassium (MOP) were applied during the time of sowing as basal and rest half of nitrogen was top dressed in two splits : One after first irrigation and other after second irrigation. Biometric observations were recorded at 25 days interval. Oats fodder was raised under irrigated condition. The field data were analyzed statistically following the standard method.

Table 1. Effect of date of sowing and variety of oats fodder on plant height and number of tillers per plant at different crop growth stages in 2007-2008 and 2000–2009 (Pooled over two years). D_1 = 15th Nov, D_2 = 30th Nov, D_3 = 15th Dec.

Treatments	Plant height (cm)			Number of tillers/plant		
	25 DAS	50 DAS	75 DAS	25 DAS	50 DAS	75 DAS
Dates of sowing (D)						
D_1	31.26	84.60	113.83	4.48	6.87	9.52
D_2	31.30	84.46	112.12	4.26	6.74	6.39
D_3	31.16	84.39	111.92	4.13	6.57	9.32
SEm (±)	0.209	0.248	0.772	0.148	0.148	0.148
CD (*p*=0.05)	NS	NS	NS	NS	NS	NS
Variety (V)						
V_1 (NDO-1)	33.47	89.92	119.68	4.22	6.78	9.44
V_2 (Kent)	33.60	90.40	119.41	3.95	6.58	9.23
V_3 (JHO-822)	29.26	80.36	118.03	3.65	6.29	8.95
V_4 (OS-6)	34.77	92.82	123.85	3.62	6.10	8.75
V_5 (UPO-212)	31.19	84.47	116.50	3.84	6.47	9.12
V_6 (JHO-851)	25.17	68.95	78.25	6.46	8.12	10.77
SEm (±)	0.295	0.350	1.091	0.210	0.209	0.209
CD (*p*=0.05)	0.845	1.003	3.127	0.602	0.599	0.599

Results and Discussion

Growth attributes

The growth attributes (viz. Plant height, number of tiller per plant, leaf area index and dry matter accumulation) were influenced significantly at different stages of growth by date of sowing and variety. The plant of oat at 25 DAS did not vary significantly at different dates of sowing. The plant height of oat at 25 DAS however, was significant with different varieties of oat (Table 1). The similar trend was also observed in 50 and 75 DAS. At 75 DAS oat cv OS-6 recorded maximum plant height (123.85 cm), which was significantly higher than all other varieties. The minimum plant height was also recorded with cv JHO-851 (78.25 cm), which was significantly lower than all other varieties.

Table 2. Effect of date of sowing and variety of oats fodder on leaf area index and dry matter accumulation at different crop growth stages in 2007-2008 and 2008-2009 (Pooled over two years). D_1 = 15th Nov, D_2 = 30th Nov, D_3 = 15 th Dec, DAS = Days after sowing, NS = Not significant.

Treatments	Leaf area index (LAI)			Dry matter accumulation (g m^{-2})		
	25 DAS	50 DAS	75 DAS	25 DAS	50 DAS	75 DAS
Dates of sowing (D)						
D_1	1.44	3.81	4.85	66.60	194.37	313.48
D_2	1.45	3.87	4.77	58.40	186.41	321.33
D_3	1.42	3.78	4.69	58.69	186.41	311.40
SEm (±)	0.033	0.043	0.028	0.590	0.597	0.437
CD (*p*=0.05)	NS	NS	NS	1.692	1.214	1.252
Variety (V)						
V_1 (NDO-1)	1.66	4.03	4.94	64.98	195.04	306.48
V_2 (Kent)	1.82	4.21	4.93	77.48	207.49	322.74
V_3 (JHO-822)	1.15	3.63	4.64	61.94	191.46	312.54
V_4 (OS-6)	1.42	3.78	4.76	87.32	215.64	378.46
V_5 (UPO-212)	1.32	3.69	4.83	41.66	170.73	299.85
V_6 (JHO-851)	1.25	3.60	4.35	34.01	154.02	254.85
SEm (±)	0.047	0.061	0.040	1.11	0.844	0.618
CD (*p*=0.05)	0.135	0.174	0.114	3.37	2.419	1.772

At 25 DAS, number of tillers/plant of oat did not vary significantly due to different dates of sowing (Table 1). At 50 DAS, the similar trend also observed on tiller number/ plant of oat but the varietal responses were however varied significantly. The maximum tiller number was recorded in cv JHO-851 (8.12 tiller/plant), which was significantly higher than that of all other varieties. At 75 DAS, tiller number of oat also did not vary significantly due to different dates of sowing but the varietal responses were also significant and maximum tiller number recorded in cv JHO-851 (10.77 tiller/plant (Table 1).

At 25 DAS, was no significant result was obtained due to different dates of sowing (Table 2). Among the varieties, the maximum LAI (1.82) was recorded with cv Kent, which was significantly higher than the other varieties. The similar trend also observed at 50 DAS. At 75 DAS, the maximum LAI (4.85 and 4.94) was recorded when sown on 15th Nov and in cv NDO-1 respectively.

At 25 DAS, dry matter accumulation in oat varied significantly due to different dates of sowing (Table 2). Maximum dry matter (66.60 g m^{-2}) accumulated with 15th Nov sown crop which was significantly higher than those of other dates of sowing (30th Nov and 30th Dec). Different varieties of oat varied significantly in respect of dry matter accumulation in oat at 25 DAS (Table 2). The highest dry matter accumulation (87.32 g m^{-2}) of oat was recorded in cv OS-6, which was signicantly greater than the other varieties, followed by cv Kent (77.48 g m^{-2}) and cv NDO-1 (64.98 g m^{-2}). At 50 DAS, the trend and variation observed was similar to that of 25 DAS (Table 2). Dry matter accumulation of oat varied significantly due to different dates of sowing. The maximum dry matter (194.37 g m^{-2}) was accumulated when sown in 15th Nov which was signicantly higher than those of other dates of sowing . The highest dry matter accumulation (215.64 g m^{-2}) was recorded in cv OS-6. At 75 DAS, the maximum dry matter accumulation (313.48 g m^{-2}) of oat was recorded when sown at 15 th Nov. The maximum dry matter was recorded in cv OS-6 (378.46 g m^{-2}) which was significantly greater than that of all other varieties. It was followed by cv Kent (322.74 g m^{-2}), cv JHO-822 (312.54 g m^{-2}) and cv NDO-1 (254.85 g m^{-2}) followed by cv UPO-212 (299.36 g m^{-2}) [1].

Yield and quality

In terms of green forage yield (GFY) of oat varied significantly due to different dates of sowing (Table 3). Significantly highest GFY (353.81 q ha^{-1}) was recorded when sown on 15 th Nov and decreased gradually when delay in sowing. The lowest GFY (347.28 q ha^{-1}) was recorded with sowing date of 15th Dec. The three dates of sowing significantly differ from each other in respect of GFY of oat [2]. The varietal responses were also significant in respect of GFY. It was found that cv NDO-1 recorded highest GFY (360.82 q ha^{-1}), which was significantly greater than the other varieties. The lowest GFY (334.63 q ha^{-1}) was recorded from cv JHO-851. Dry matter of oat varied significantly due to different dates of sowing (Table 3). The highest dry matter yield (56.46 q ha^{-1}) was recorded from the earliest sowing (15th Nov). The results indicated that the dry matter yield decreases gradually after 15th Nov the significant re-

Table 3. Effect of date of sowing and variety of oats fodder on green and dry fodder yield at harvest stage in 2007-2008 and 2008-2009 (pooled over two years). D_1 = 15th Nov, D_2 = 30th Nov, D_3 =15th Dec, q ha^{-1} + Quintal per hectare.

Treatments	Green fodder yield (q ha^{-1})	Dry fodder yield (q ha^{-1})
Dates of sowing (D)		
D_1	353.81	56.46
D_2	349.82	55.59
D_3	347.28	54.84
SEm (±)	0.758	0.508
CD (p =0.05)	2.173	1.456
Variety (V)		
V_1 (NDO-1)	360.83	58.90
V_2 (Kent)	356.92	54.22
V_3 (JHO-822)	341.70	52.03
V_4 (OS-6)	352.66	62.01
V_5 (UPO-212)	355.11	56.34
V_6 (JHO-851)	334.63	49.85
SEm (±)	1.072	0.722
CD (p = 0.05)	3.073	2.064

duction was recorded in the sowing date after 30 th Nov [3].

In terms of crude protein yield (CPY) of oat did not vary significantly due to dates of sowing (Fig. 1). However, the highest crude protein yield (5.94 q ha^{-1}) was recorded when sown on 30th Nov. The lowest crude protein yield (5.87 q ha^{-1}) was recorded with 15th Dec sowing date. The varietal responses were significant in respect of crude protein yield (Fig 1). The maximum crude protein yield (6.60 q ha^{-1}) was recorded in cv OS-6, which was statistically at par with cv Kent (6.52 q ha^{-1}). The lowest CPY was obtained with cv NDO-1 (5.13 q ha^{-1}) (Fig.1) [4].

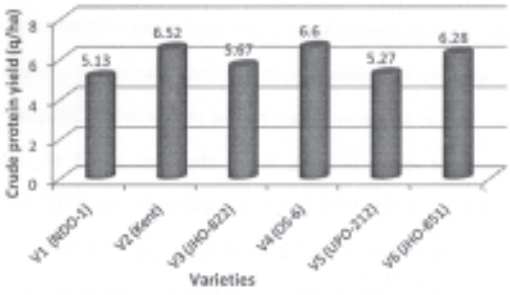

Fig. 1. Effect of date of sowing and variety on total crude protein yield (kg ha^{-1}) of fodder oats in 2007-2008 and 2008-2009 (pooled over two years).

Conclusion

From the field experiment findings, it may be concluded that date sowing of 15th November is the best in increasing the forage yield and quality of oats and variety OS-6 proved to be the suitable variety for this new alluvial zone of West Bengal.

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