International Journal of Chemical Studies

P-ISSN: 2349–8528
E-ISSN: 2321–4902
IJCS 2019; 7(5): 2221-2223

Received: 01-07-2019
Accepted: 03-08-2019

SA Rahate
Department of Agronomy, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola, Maharashtra, India

AB Chorey
Department of Agronomy, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola, Maharashtra, India

SM Sawadhkar
Department of Agronomy, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola, Maharashtra, India

NN Deshatwar
Department of Agronomy, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola, Maharashtra, India

Corresponding Author:
SA Rahate
Department of Agronomy, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola, Maharashtra, India

Forage productivity of oat as influenced by silicon and cutting management

SA Rahate, AB Chorey, SM Sawadhkar and NN Deshatwar

Abstract
An agronomic investigation was carried out on oat cv. RO-19 (Phule harita) at Agronomy farm, Dr. PDKV, Akola during *Rabi* season of 2016-17 to study the growth and productivity dynamics of fodder oat as influenced by silicon and cutting management. Silicon levels, application of silicon @ 400 kg ha^{-1} recorded significantly higher growth attributes *viz.* plant height, no. of tillers, leaf: stem ratio, dry matter accumulation plant^{-1} and yield attributes *viz.* Green forage yield, seed yield and straw yield. Gross Monetary Returns, Net Monetary Returns and Benefit: Cost ratio. Among the cutting management, no cut treatment recorded highest plant height, and dry matter accumulation plant^{-1}, seed yield and straw yield, while cut at 55 DAS produced significantly higher number of tillers at harvest, green forage yield, Gross Monetary Returns, Net Monetary Returns and Benefit: Cost ratio.

Keywords: Oat, silicon, cutting management, plant height, fodder yield

Introduction

Maharashtra has about 4.0 crores of livestock population which needs about 14 crores tones of dry fodder. However, only 9 crores tones dry fodder is available from all sources. It means about 42% fodder is deficit for livestock in Maharashtra. (IGFRI, 2011) [4]. Around 97% available fodder is of poor quality (Aher *et al.*, 2013) [1]. Forage is the cheapest source of animal feed. It supply desired amount of proteins, energy, minerals as well as vitamins to a large extents. Looking to the present quantitative and qualitative insufficiency of feeds, fodders and good quality forage seed in our country, less nutrients availability to the animals is obvious.

Oat (*Avena sativa* L.), locally known as "jai" is an important non-legume, cereal forage crop, grown during *rabi* season. It is a palatable, succulent and nutritious crop. The protein quality of oat is excellent. It is rich in energy, protein, vitamin B, phosphorous and iron (Tiwana *et al.*, 2008) [12].

Cutting management in oat is an important aspect since it governs the quality and quantity of green forage yield. In general cutting management may follow in fodder crops for higher yields. Cutting exhibits the effect on nutrient and natural resource utilization by the crop. Silicon nutrition also manages many abiotic stresses including physical stresses like lodging, drought, radiation, high temperature, freezing and chemical stresses like salt, metal toxicity and nutrient imbalance (Epstein, 1994) [2]. In view of these facts, the present investigation was carried out for increasing good quality forage supply by adopting improved agronomic techniques.

Material and methods

An investigation was carried out at Agronomy farm, during *Rabi* season of 2016 to evaluate the growth and productivity dynamics of fodder oat (cv. RO-19, Phule harita) as influenced by silicon levels and cutting management. An experiment was laid out in factorial randomized block design with three replications. The treatments comprising of four silicon levels *viz.* 0, 200, 300 and 400 kg Si ha^{-1} and three cutting *viz.* no cut, cutting at 45 and 55 DAS. Sowing was done at spacing of 30 cm row to row.

Results and discussion

Growth and yield of oat as influenced by different treatments

The data in the table 1 indicated that, among levels of silicon, all the growth and yield attributing characters attributes successively increased with increasing application of silicon.

Significantly maximum plant height (120.78 cm), no. of tillers (per meter row length) (117.99), leaf: stem ratio at 40 DAS (1.77), dry matter accumulation plant^{-1}(25.75 g), green with application of silicon @ 400 kgha^{-1} and which significantly superior over silicon application @ 200 kgha^{-1}and control treatment and at par with silicon application @ 300 kgha^{-1}. The application of silicon enhanced photosynthetic activity, water and nutrient use efficiency, which ultimately results into higher seed and straw yield, was mainly associated with increased plant height and number of tillers. These results are corroborating with the finding of Patil *et al.* (2017a) [10] and Malav *et al.* (2017) [7].

Table 1: Effect of levels of silicon and cutting management on different growth and yield attributes of oat.

Treatment	Plant height (cm)	No. of tillers m^{-1} row length)	Dry matter accumulation plant^{-1}(g)	Leaf: stem ratio (40 DAS)	Green forage yield (qha^{-1})	Seed yield (qha^{-1})	Straw yield (qha^{-1})
A. Levels of silicon							
S_1 - 0 (control)	111.60	107.43	21.75	1.34	153.76	13.83	110.48
S_2 - 200 kg ha^{-1}	116.25	115.02	23.95	1.43	231.34	15.11	126.03
S_3 - 300 kg ha^{-1}	118.44	116.70	24.40	1.58	288.90	16.03	132.58
S_4 - 400 kg ha^{-1}	120.78	117.99	25.75	1.77	301.66	16.73	142.75
SE(m)±	2.24	2.70	0.94	0.07	12.30	0.71	5.04
CD at 5%	6.56	7.92	2.77	0.22	37.31	2.07	14.78
B. Cutting management							
C_1 - No cut	128.56	105.14	27.45	1.57	_	18.35	157.83
C_2 - 45 DAS	116.53	117.09	24.08	1.43	171.26	14.96	144.54
C_3 - 55 DAS	105.23	120.63	20.37	1.59	316.57	12.97	81.50
SE(m)±	1.94	2.34	0.82	0.06	8.70	0.61	4.36
CD at 5%	5.68	6.86	2.40	NS	26.38	1.79	12.80
C. Interaction A x B							
SE(m)±	3.88	4.68	1.63	0.13	17.40	1.22	8.73
CD at 5%	NS	NS	NS	NS	57.76	NS	NS

Cutting management produced significant effect on growth and yield attributing characters. No cut recorded significantly highest plant height (128.56 cm) and dry matter accumulation plant^{-1}(27.45 g) as compare to cut at 45 DAS and cut at 55DAS. This might be due to uninterrupted growth of crop. Secondly continuous vertical growth of the crop ultimately reflected in higher dry-matter production. However, cut at 55 DAS recorded higher no. of tillers (120.63) as compare to cut at 45 DAS and no cut treatment. Similarly, cut at 55 DAS also produced significantly higher green forage yield (316.57 q ha^{-1}) over no cut and cut at 45 DAS. While, highest seed yield (18.35 q ha^{-1}) and straw yield (157.83 q ha^{-1}) was produced by no cut treatment which was superior as compared to cut at 45 and 55 DAS, this might be due to maximum period for crop growth and development than cut at 45 and 55 DAS which resulted in adequate food supply to sink and ultimately reflected into better development of seed and straw yield. These results are corroborating with the finding of Karwasra *et al.* (2007) and Patel *et al.* (2013). Significantly highest green fodder yield was recorded when crop was cut at 55 DAS as compared cut at 45 DAS which might be due to fast development of secondary tillers, increased in green forage yield due to more crop duration in 55 days of cutting than 45 days of cutting which increased growth period up to 10 days and rise in plant height resulted in higher yield.

Interaction effect

Perusal of data (Table 2) indicates that the interaction between levels of silicon and cutting management was found to be significant in respect of green forage yield. Application of silicon 400 kgha^{-1} along with cutting at 55 DAS (S_4 x C_3) recorded maximum green forage
yield, being comparable with silicon 300 kgha^{-1} along with cutting at 55 DAS (S_3xC_3) found significantly superior over all the treatment combinations.

Table 2: Mean green forage yield (qha^{-1}) as influenced by levels of silicon and cutting management interaction at cut

S/C	C_1 - No cut	C_2 - 45 DAS	C_3 - 55 DAS	Mean
S_1- 0 (control)	-	119.67	187.85	153.76
S_2- 200 kg ha^{-1}	-	133.59	329.08	231.34
S_3- 300 kg ha^{-1}	-	208.68	369.12	288.90
S_4- 400 kg ha^{-1}	-	223.10	380.22	301.66
SE(m)±	17.40			
CD at 5%	57.76			

Among the silicon levels, highest gross monetary returns of (Rs. 96330 ha^{-1}), net monetary returns (Rs. 60595 ha^{-1}) and B:C ratio (2.66) were obtained with application of silicon @ 400 kg ha^{-1}, which was significantly superior over control and application of silicon 200 kg ha^{-1} and was found comparable with silicon application @ 300 kgha^{-1}. Similar results were reported by Jawahar and Vaiyapuri (2010) [5].

Cutting management had significant influence on gross monetary returns, net monetary returns and B: C ratio. Highest gross monetary returns (Rs. 103882 ha^{-1}), net monetary returns (Rs. 67597 ha$^{-1)}$ and B:C ratio (2.85) were obtained in cutting at 55 DAS which was found superior as compare to cut at 45 DAS and no cut. Similar results were reported by Sharma and Bhunia (2001) [11].

Table 3: Gross monetary returns, net monetary returns and B: C ratio of sunflower as influence by different treatments.

Treatment	GMR (Rs ha^{-1})	NMR (Rsha^{-1})	B:C Ratio
A. Levels of silicon			
S_1- 0 (control)	66116	34381	2.08
S_2- 200 kg ha^{-1}	81231	47496	2.39
S_3- 300 kg ha^{-1}	91841	57106	2.61
S_4- 400 kg ha^{-1}	96330	60595	2.66
SE(m)±	2516	2516	-
CD at 5%	7379	7379	-
B. Cutting management			
C_1- No cut	61660	32275	2.10
C_2- 45 DAS	86096	49811	2.37
C_3- 55 DAS	103882	67597	2.85
SE(m)±	2179	2179	-
CD at 5%	6390	6390	-
C. Interaction A x B			
SE(m)±	4358	4358	-
CD at 5%	12780	12780	-

Interaction Effect

Data shown in Table 4 indicated that, silicon application @ 400 kgha^{-1} along with cutting at 55 DAS treatment combinations recorded the highest NMR and was found at par with application of silicon level @ 300 kgha^{-1} along with cutting at 55 DAS treatment combination and significantly superior over all other remaining treatment combinations.

Table 4: Mean NMR (Rs.ha^{-1}) as influenced by levels of silicon and cutting management interaction

Net monetary returns (Rs.ha^{-1})				
Treatments	**B. Cutting management**			
A. Levels of silicon	**C_1 : No cutting**	**C_2 : 45 DAS**	**C_3 : 55 DAS**	**Mean**
S_1 : 0 (control)	30426	35040	37677	34381
S_2 : 200 kgha^{-1}	32110	41750	68628	47496
S_3 : 300 kgha^{-1}	32639	60156	78525	57106
S_4 : 400 kgha^{-1}	33926	62298	85560	60595
SE (m)±	4358			
CD at 5%	12780			

Conclusion

The study indicated the positive effect of silicon application, thus, it can be concluded that application of silicon @400 kg ha^{-1} and 300 kgha^{-1} along with cut at 55 DAS recorded comparable and significantly higher green forage yield and net monetary returns.

References

1. Aher VB, Tambe AB, Manjare MR, Desale JS. Forage Research in Maharashtra. Book Published by Forage Research Project, MPKV, Rahuri (MS), 2013.
2. Epstein E. The anomaly of silicon in plant biology. Proc. Natl. Acad. Sci. USA. 1994; 91:11-17.
3. Fischer RA. Statistical methods for research workers (14th Ed.), Oliver and Boyd, London, 1970.
4. IGFRI. Vision 2030: In: Pandey, K C., Roy, AK. (ed) Forage Crops Varieties. IGFRI, Jhanshi, India. 2011, 23-27.
5. Jawahar S, Vaiyapuri V. Effect of sulphur and silicon fertilization on growth and yield of rice. Int. J Curr. Res. 2010; 9:036-038.
6. Karwasra RS, Kumar Y, Kumar V, Kumar A. Integrated nutrient and cutting management in oat. Forage Res. 2007; 33(1):63-64.
7. Malav JK, Ramani VP, Sajid M, Kadam GL. Influence of nitrogrn and silicon fertilization on yield and nitrogen and silicon uptake by rice (*Oryza sativa* L.) under lowland conditions. Research Journal of Chemistry and Environment. 2017; 21(8):45-49.
8. Panse VG, Sukhatme PK. Statistical methods for Agricultural workers. ICAR Publications, New Delhi, 1978, 199-210.
9. Patel TU, Arvadia MK, Patel DD, Thanki JD, Patel HM, 2013. Response of oat (*Avena sativa* L.) to cutting management and times of N application. Res. on Crops., 14(3):902-906.
10. Patil AA, Durgude AG, Pharande AL, Kadlag AD, Nimbalkar CA. Effect of calcium silicate as a silicon source on growth and yield of rice plants. Int. J. Chem. Studies. 2017; 5(6):545-549.
11. Sharma SK, Bhunia SR. Response of oat to cutting management, method of sowing and nitrogen. Indian J Agron. 2001; 46(3):563-567.
12. Tiwana US, Puri KP, Chaudhary DP. Fodder productivity quality of multicut oat grown pure and in mixture with different seed rates of sarson. Forage Research. 2008; 33(4):224-226.