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Yield, quality and economics of fodder oat varieties in response to sowing windows

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ABSTRACT

A field experiment was conducted during *rabi*, 2024-25 on sandy loam soils of dryland farm of S.V. Agricultural College, Tirupati of Acharya N.G. Ranga Agricultural University. The treatments details include three varieties viz., V_1: RO-11-1, V_2: OS-403 and V_3: OS-6 with five sowing windows viz., S_1: October I FN, S_2: October II FN, S_3: November I FN, S_4: November II FN and S_5: December I FN. The experiment was laid in the randomized block design with factorial concept and replicated thrice. The results of the experiment revealed that variety RO-11-1 sown during November II FN recorded significantly higher green fodder (18104 kg ha^{-1}) and dry fodder yield (4735 kg ha^{-1}). In terms of quality parameters, crude protein content (8.51%) was higher with the variety RO-11-1 sown during November II FN while lowest crude fibre (25.12%) and total ash content (8.73%) recorded with RO-11-1 sown during November I FN, indicates good quality fodder comparable with November II FN. High net monetary returns (43889 Rs ha^{-1}) was registered with RO-11-1 sown during November II FN.

Keywords:*Fodder oat, Quality parameters, Sowing windows and Economics*

In India, livestock population is increased by 4.6% compared to 2012 livestock census, but the land utilized for fodder production is only 4.4% of total cultivated area. Due to this, there is acute shortage of green fodder and dry fodder to the tune of 40 and 23% respectively. To meet the demand of fodder for the growing livestock population, the possible alternate methods should be choosen. Such alternate for Southern region is introduction of non-traditional oat crop.

Oat (*Avena sativa* L.) is an important *rabi* fodder crop. It is mostly grown in Northern regions of India, due to favourable climate. Oats have high nutritive value and adapt well to cooler environment. With quick growing habit, shorter duration, high palatability, good nutritive value with an abundance of green fodder yield, oats crop offers a better opportunity to cultivate this crop in Southern parts of the country though it is a non-traditional crop. Identifying high yielding fodder crop varieties are necessary to meet the nutritional requirements of the animals.

The productivity and quality of fodder is believed to be significantly influenced by number of factors including time of sowing. It has been observed that both very early and late sowing conditions have negative impact on yield. Since oat is typically sown in October and November, fodder yield levels tends to fluctuate significantly with early and late sown conditions owing to temperature variations during the growing season. Even though the better adaptability of oats in Southern parts of the country the spread of this crop is limited because of lack of knowledge on production package.

Keeping these things in view the present investigation was carried out to find out the suitable varieties under specific sowing windows for higher green and dry fodder yield, quality and profitability in the Southern Agroclimatic Zone of Andhra Pradesh.

MATERIAL AND METHODS

The field experiment was conducted during *rabi*, 2024-25 at dryland farm of S.V. Agricultural College, Tirupati of Acharya N.G. Ranga Agricultural University, Andhra Pradesh which is geographically situated at 13.5°N latitude and 79.5°E longitude at an altitude of 182.9 m above mean sea level. The soil of experimental site was sandy loam having 0.38%

organic carbon, 220 kg ha^{-1}, 34 kg ha^{-1} and 249 kg ha^{-1} of available N, P_2O_5 and K_2O respectively. A total rainfall received during the crop period was 665.8 mm in 29 rainy days. The experiment was laid out in a randomized block design with factorial concept with fifteen treatments and replicated thrice. Treatments include three varieties *viz*., V_1: RO-11-1, V_2: OS-403 and V_3: OS-6 and five sowing windows *viz*., S_1: October I FN, S_2: October II FN, S_3: November I FN, S_4: November II FN and S_5: December I FN. The crop was sown at 30 cm x 10 cm spacing with a seed rate of 100 kg ha^{-1}. The recommended fertilizer dose of 80 kg N, 40 kg P_2O_5 and 30 kg K_2O ha^{-1} where, half of the N and whole amount of P and K was applied as basal and the remaining half of nitrogen was applied at 30 DAS. Irrigation and weeding were done as and when required. The crop was harvested for green fodder at 50% flowering stage, where the quality parameters like crude protein and crude fibre content are at their peak levels.

Green fodder yield of forage oat from the net plot area was taken separately by leaving 5 cm stubbles from ground surface and expressed in kg ha^{-1}. After harvesting fodder oat from net plot area, heaps were left in the field for one week for sun drying. Then dry fodder yield of oat from net plot area was weighed and total dry fodder yield was expressed in kg ha^{-1}.

The method followed for analysis of proximate principles in fodder was the one recommended by Association of Official Analytical Chemists (A. O. A. C., 1990). Total nitrogen content of plant samples was estimated by modified Micro kjeldhal method and the crude protein content was estimated by using the following formula which was expressed in percentages.

$$\text{Crude protein (\%)} = \text{N (\%)} \times 6.25$$

Crude fibre content in whole plant was estimated by acid-alkali digestion method and was expressed in percentage.

$$\text{Crude fibre (\%)} = \frac{\text{weight before ashing - weight after ashing}}{\text{weight before ashing}} \times 100$$

Ash is the inorganic component of the sample left after complete ignition of the sample at 600^{o}C in muffle furnace. Total ash content was calculated by using the following formula and expressed in percentage.

$$\text{Total ash content (\%)} = \frac{\text{Weight of the ash}}{\text{Weight of oven dry sample}} \times 100$$

Gross returns, net returns and benefit cost ratio were worked out by using the following formula:

Gross returns (₹ ha^{-1}) = Yield × Unit cost

Net returns (₹ ha^{-1})=

Gross returns - Total cost of cultivation

$$\text{Benefit-cost ratio} = \frac{\text{Gross returns (₹ ha}^{-1}\text{)}}{\text{Cost of cultivation (₹ ha}^{-1}\text{)}}$$

The data collected on various crop parameters were statistically evaluated analysis of variance for randomized block design with factorial concept method recommended by Panse and Sukhatme (1985).

RESULTS AND DISCUSSION

Yield Parameters

The variety RO-11-1 registered significantly higher green and dry fodder yield compared to other varieties, while OS-403 variety registered the lower green and dry fodder yield which was statistically similar to that of OS-6 (Table 1). Increase in green and dry fodder yield of RO-11-1 than other varieties could be attributed to its genetic potentiality to utilize and translocate the photosynthates from source to sink resulting in better performance of growth and yield parameters. Further the performance of RO-11-1 variety in producing higher values of plant height, leaf area and leaf to stem ratio has resulted in increased photosynthate accumulation which were directly related to the production of bulk herbage. Similar results were obtained by Kashyap *et al*. (2022), Jindal *et al*. (2024), Sarkar *et al*. (2022) and Satpal *et al*. (2024). Among the varied sowing windows, November II FN sown crop recorded significantly higher green and dry fodder yield followed by December I FN, November I FN and October II FN with significant disparity among them. The lower green and dry fodder yield were recorded during October I FN (Table 1). This might be due to the

Table 1. Green and dry fodder yield of fodder oat as influenced by varieties and sowing windows

Treatments	Green fodder yield (kg ha^{-1})	Dry fodder yield (kg ha^{-1})
Varieties		
V_1: RO-11-1	12538	3643
V_2: OS-403	11467	2648
V_3: OS-6	11558	2710
SEm±	176	87
CD (P=0.05)	510	254
Sowing windows		
S_1: October I FN	3335	829
S_2: October II FN	5966	1502
S_3: November I FN	14513	3581
S_4: November II FN	18104	4735
S_5: December I FN	17354	4354
SEm±	227	113
CD (P=0.05)	659	328
Varieties × Sowing windows		
SEm±	394	195
CD (P=0.05)	NS	NS

availability of favourable microclimate and macroclimate during the crop growth period resulted in luxuriant growth in terms of growth parameters, which ultimately lead to higher fodder yield. The present findings corroborate with that of Murali *et al*. (2021), Megharaja *et al*. (2023) and Samal *et al*. (2024).

Quality Parameters

The optimum level of crude protein (CP) in fodder oats typically ranges from 7% to 15% of the dry matter (DM). Higher crude protein content is a key characteristic of high-quality fodder. Significant differences were not observed in crude protein content of fodder oat either by varieties or by different sowing windows. However, higher crude protein content of fodder oat was observed with variety RO-11-1 followed by OS-6 and the lowest crude protein content was recorded with OS-403. Among sowing windows, November II FN sown crop recorded in higher crude protein content, while it was lower with October I FN sown crop (Table 2).

For high-quality fodder oats, the optimum crude fibre content is 25–30% (on dry matter basis). Negative relationship between crude fibre content and crop quality. The crude fibre content of fodder oat was not influenced by varieties but significant differences were observed with different sowing windows. Higher crude fibre content of fodder oat was observed with variety OS-403 followed by OS-6 and the lowest crude fibre content was recorded with RO-11-1. Among the sowing windows tried, significantly higher crude fibre content was recorded with October I FN sown crop followed by October II FN, December I FN and November II FN with significant disparity between them. The lower crude fibre content was noticed during November I FN which was comparable with November II FN sown crop (Table 2). The results were in conformity with the findings of Jehangir *et al*. (2013) and Kadam *et al*. (2020).

The typical range for total ash content in fodder oats is approximately 8% to 12% of the dry matter (DM). Higher ash content can sometimes indicate contamination with soil or Over-fertilization. The influence of fodder oat varieties on total ash content was found to be non-significant. OS-403 variety recorded higher total ash content followed by OS-6 variety. The lower total ash content was recorded with RO-11-1. Significantly, higher total ash content was noticed during October I FN sown crop followed by October II FN, December I FN and November II FN with significant difference among each other. Statistically lower total ash content was noticed with November I FN sown crop (Table 2).

Table 2. Crude protein, crude fibre and total ash content (%) of fodder oat as influenced by varieties and sowing windows

Treatments	Crude protein	Crude fibre	Total ash
Varieties			
V_1: RO-11-1	8.3	25.94	10.49
V_2: OS-403	7.87	26.37	10.87
V_3: OS-6	8	26.31	10.56
SEm±	0.147	0.142	0.119
CD (P=0.05)	NS	NS	NS
Sowing windows			
S_1: October I FN	7.72	27.36	12.46
S_2: October II FN	7.84	26.73	11.63
S_3: November I FN	8.03	25.12	8.73
S_4: November II FN	8.51	25.62	9.82
S_5: December I FN	8.19	26.2	10.58
SEm±	0.189	0.184	0.154
CD (P=0.05)	NS	0.53	0.45
Varieties × Sowing windows			
SEm±	0.328	0.318	0.267
CD (P=0.05)	NS	NS	NS

Table 3. Economics of fodder oat as influenced by varieties and sowing windows

Treatments	Gross returns (₹ ha^{-1})	Net returns (₹ ha^{-1})	Benefit:Cost ratio
Varieties			
V_1: RO-11-1	50151	21625	1.76
V_2: OS-403	45868	17342	1.61
V_3: OS-6	46233	17707	1.62
SEm±	704.7	704.7	0.025
CD (P=0.05)	2041	2041	0.07
Sowing windows			
S_1: October I FN	13340	-15186	0.47
S_2: October II FN	23864	-4662	0.84
S_3: November I FN	58051	29525	2.03
S_4: November II FN	72415	43889	2.54
S_5: December I FN	69417	40891	2.43
SEm±	909.8	909.8	0.032
CD (P=0.05)	2635	2635	0.09
Varieties × Sowing windows			
SEm±	1575.8	1575.8	0.055
CD (P=0.05)	NS	NS	NS

This might be due congenial weather parameters prevailed during the crop growth period. These observations were similar to the findings of Dar *et al.* (2014) and Singh and Sidhu, (2020).

Economics

Higher gross returns, net returns and B:C ratio were realized with variety RO-11-1 followed by OS-6 and the lowest values were with OS-403, which

was on par with OS-6 (Table 3). Lower monetary returns were realized with OS-403 due to its poor performance in terms of producing green fodder yield. Similar results were supported by Satpal *et al*. (2018) and Samal *et al*. (2023).

Maximum gross returns, net returns and B:C ratio were obtained during November II FN followed by December I FN, November I FN and October II FN with significant disparity with one another. While minimum values were recorded with October I FN sown crop (Table 3). Favourable micro and macro climatic conditions during November II FN increased the green fodder yield which inturn increased the returns. Statistically lower net returns, negative net returns were recorded with October I FN and II FN sown crop indicating the influence of weather parameters on growth and yield of fodder oat in Southern Agroclimatic Zone of Andhra Pradesh. Higher green fodder yield and net returns obtained during November II FN sown crop might be responsible for higher benefit-cost ratio. The results are in line with the findings of Kadam *et al*. (2020), Megharaja *et al*. (2023) and Samal *et al*. (2023).

CONCLUSION

The variety RO-11-1 sown during November II FN was found to be most efficient in obtaining better growth, higher yield and economic returns whereas, November I FN sown crop exhibited better quality parameters compared to other sowing windows.

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