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Production and Productivity of Oat (*Avena sativa* L.) Cultivars as Fodder Crop on Hilly Terraces of Nagaland under Rainfed Condition

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ABSTRACT

Background: Agricultural background of rural India, maintaining cattle is very important, but due to the lack of pasture land and fodder production, it is tough to maintain the cattle with the farmers. However, producing fodder crops throughout the year makes it possible to maintain cattle. During the rainy season, different grasses are available, but during the *rabi* season dry period, fodder becomes scares, so growing fodder oats will compensate during the lean period.

Methods: A field experiment was conducted during the *rabi* season of 2019 and 2020 at the experimental research farm, School of Agricultural Sciences, Nagaland University, Medziphema. The experiment consisted of six varieties of oat, namely, V1-OS-346, V2-OS-403, V3-WJ-8, V4-OS-6, V5-OS-7 and V6-OS-377, which were laid out in randomized block design (RBD) with four replications to find out the best suitable variety under rainfed condition of Nagaland.

Result: The study revealed that all the oat varieties grew well under Nagaland conditions. The variety OS-403 recorded the highest plant height (72.69 cm) and was at par with variety WJ-8 (72.43 cm). Among the varieties, green fodder yield and dry matter yield were significant. The variety OS-403 recorded the highest green fodder yield (148 q/ha), followed by WJ-8 (143.11 q/ha). Similar is the trend for dry matter yield. The variety OS-403 recorded the highest dry matter yield (27.97q/ha), at par with variety WJ-8 (27.22 q/ha). Crude protein content (%) and crude protein yield (q/ha) were non-significant among the different oat varieties.

Key words: Fodder crop, Growth, Oat, Quality parameters, Variety, Yield.

INTRODUCTION

Cereal crops are well known for having higher green biomass productivity. Among the different cereals, oats produce the greenest fodder per square foot per hour with the least amount of irrigation (Ahmad *et al*., 2013). Oats (*Avena sativa* L.) is a significant cereal crop grown in temperate and subtropical regions worldwide during winter. Cereal production comes in behind sorghum, wheat, maize, rice, barley, and maize (Hoffman, 2009), with 9.23% fat, 3.56% protein, 30.44% fiber, 0.82% calcium and 0.27% phosphorus all included in oats. In India, oats are a unique fodder crop planted in *rabi* because of their increased dry matter content, 7-10% protein content, disease tolerance, and suitability for silage production (Ahmad *et al*., 2014). Oats are grown for their grains, forage, fodder, straw for bedding, hay, haylage, silage and chaff.

India's livestock sector experiences challenges such as low productivity, high cost of commercial feed, low green fodder production, insufficient availability of dry fodder, and low level of technology. In India, cultivated fodder is limited to 4.9% of the total cropped area (Kumar *et al*., 1992). The introduction of varieties that have the potential to produce higher seed yields can be used to attract farmers for seed production of forage crops, particularly oats. Increased nutritional demand for optimal animal performance has challenged producers to select superior oat varieties and combine good management practices to produce crops with high yields and favorable quality characteristics (Kim *et al*., 2006).

The northeastern region is mainly agricultural and agrarian in nature. Agriculture is the main livelihood in Nagaland, with livestock raising coming in second. According to reports, the state's cattle population is far larger than the fodder needed and production is insufficient to meet population needs. In Nagaland, oat is a significant *rabi* fodder crop, but current production is not keeping up with demand. Consequently, bridging the gap between fodder production and demand is difficult (Ahmad *et al*., 2016). To close the supply-demand gap for green fodder, forage oat types with a higher yield, better quality and tolerance to abiotic stress

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are urgently needed (Ahmad *et al*., 2015), which would lead to an increase by 2-3 folds (Kumar, 2014 a, b; Kumar (2013); Kumar (2012). In light of this, the current study assessed the productivity and quality of various oat cultivars for use as fodder in the hilly terraces of Nagaland.

MATERIALS AND METHODS

The field experiment was carried out in the experimental farm of the School of Agricultural Sciences (SAS) Nagaland University, Campus-Medziphema, during the *rabi* season of 2019 and 2020. The farm is situated at the foothill of Nagaland at 310 meters above the mean sea level with a geographical location of 25°45′43″ North latitude and 95°53′ 04″ East longitude.

The average temperature during summer varies from 21-32°C, while during winter it varies from 8-20°C. The average rainfall varies from 2000-2500 mm starting from April, whereas in November-March, it is dry. The experimental plot's soil was acidic, well-drained and sandy loam in texture. The experiment was carried out with the following oat varieties, V1-OS-346, V2-OS-403, V3-WJ-8, V4-OS-6, V5-OS-7, V6-OS-377, replicated four times. The cultivation practices were the same for all the treatments. Observation to be recorded on 6 cultivars *viz.,* growth, and yield quality and soil parameters. The growth, yield and quality attributes are plant height (cm), green fodder yield (q/ha), dry matter yield (q/ha), crude protein yield (q/ha) and crude protein content (%) and statistical analysis. Determination of the nutrient status of the soil before sowing and after crop harvesting was observed and recorded from all 18 plots.

RESULTS AND DISCUSSION

The results of various parameters were discussed in this chapter. The data noted for progressive growth of oat, yield, and quality parameters are presented in Table 1.

Growth parameter

Among the different varieties, the highest plant height was recorded in the variety WJ-8 with 71.86 cm at harvest, which is at par with OS-346 with 71.19 cm. And the lowest was recorded in the variety OS-346 with 56.74 cm. Differences in plant height among the varieties were expected due to the genetic makeup of the varieties and environmental influences. However, the plant heights among the cultivars were found to be non-significant. The effect of variety on plant height in the present study agreed with previous findings (Chohan *et al*., 2004; Hussain *et al*., 2005; Palsaniya *et al*., 2015). Similar patterns of growth in oat have also been reported by Kumar *et al*. (1992); Lupingan *et al.* (1999), Naeem *et al*. (2002) and Ahmad *et al.* (2008).

Yield parameter

The highest green fodder yield (GFY) was recorded in the variety OS-403 with 142.50q/ha, followed by the variety WJ-8 with 138.17q/ha and the lowest was recorded in the variety OS-346 with and 85.50q/ha. And for dry matter yield (DMY) the highest was also recorded in the variety OS-403 with 26.89 q/ha which is at par with WJ-8 (26.16 q/ha) and OS-6 (24.48 q/ha). Green as well as dry fodder yield of oat varieties were influenced significantly with their different genetic constituents. The improvement in the fodder yield could be attributed to improved growth parameters *viz*., plant height and tiller number (Hussain *et al*., 2016). These results were also in conformity with the earlier findings of Choudhary *et al*., 2016; Dar *et al*., 2014; and Palsaniya *et al*., 2015. These results were also in close conformity with the findings of Lu pingan *et al*. (1999); Naeem *et al*. (2002) and Singh and Singh (1992).

Quality parameter

Crude protein content (%) and crude protein yield (q/ha) were also recorded the highest in the variety WJ-8 with 9.96% crude protein content which was at par with OS-346 (9.26%) and OS-377 (9.07%) and 2.49 q/ha crude protein yield which was at par with the variety OS-403 (2.45). Whereas the lowest was recorded in the variety OS-7 with 7.43% crude protein content and the lowest crude protein yield was recorded in the variety OS-346 with 1.49 q/ha. The variation in fodder quality might be due to the different genetic constitutions of different varieties (Ahmad *et al*., 2015). Moreover, the results also agreed with the earlier findings of Choudhary *et al*., (2016); Dar *et al*., (2014) and Palsaniya *et al*., (2015).

Table 1: Growth and yield of different oat cultivars under Nagaland conditions.

Treatments	Plant height (cm) DAS			GFY(q/ha)	DMY(q/ha)	Crude protein content (%)	Crude protein yield (q/ha)
	30	60	Harvest				
V1-OS-346	9.78	25.23	57.24	88.00	16.58	9.57	1.58
V2-OS-403	10.20	24.75	72.69	148.00	27.97	9.20	2.59
V3-WJ-8	10.82	28.48	72.43	143.11	27.22	10.06	2.73
V4-OS-6	9.75	24.03	66.93	131.17	24.40	8.81	2.15
V5-OS-7	10.68	26.50	69.92	121.00	22.39	9.94	2.23
V6-OS-377	9.10	20.85	64.96	124.67	23.96	9.51	2.28
CV (%)	11.18	13.77	10.78	14.45	14.86	6.38	17.19
SEm±	0.65	1.99	4.19	10.51	2.04	0.35	0.22
CD (P=0.05)	NS	NS	NS	39.15	7.59	NS	NS

Table 2: Soil pH, Org. C (%), available N, P and K (kg/ha).

Treatments	Before sowing					After harvest				
	Soil pH	Org. C.	N	P	K	SoilpH	Org. C.	N	P	K
V1-OS-346	4.37	1.30	207.28	19.34	225.15	4.60	1.04	183.42	19.89	218.41
V2-OS-403	6.60	1.31	206.18	18.33	222.19	4.47	0.98	186.03	18.18	215.28
V3-WJ-8	4.53	1.42	203.17	19.25	219.18	4.50	1.01	177.03	20.33	214.46
V4-OS-6	4.87	1.45	203.85	19.91	212.81	4.73	1.03	175.86	20.93	217.88
V5-OS-7	4.77	1.42	200.98	17.89	215.43	4.63	1.01	178.44	19.07	212.21
V6-OS-377	4.67	1.28	203.46	18.74	217.81	4.50	0.97	180.97	18.69	209.96
CV (%)	2.59	9.29	1.63	5.63	3.42	2.81	4.42	4.02	3.22	4.63
SEm±	0.07	0.07	1.92	0.61	4.30	0.07	0.02	4.18	0.36	5.74
CD (P=0.05)	NS	NS	NS	NS	NS	NS	NS	NS	1.35	NS

Soil parameters

Soil parameters such as pH, OC and available N, P, K before and after sowing were analyzed and presented in Table 2. Results showed no significant differences in different soil parameters except available P. These results were statistically similar to the findings of Waheed *et al*., (2012) and Mohr *et al*., (2007).

CONCLUSION

Oats varieties are coming up with good green fodder yield in the hilly terraces of Nagaland. Among the six different oat varieties, OS-403 was found to perform better under rainfed condition than the other varieties, giving the highest green fodder yield, followed by variety WJ -8 and OS-6, respectively. The trend for dry matter production also followed a similar trend as green fodder yield. In crude protein yield, except for one variety OS-346 all other varieties recorded more than 2 q/ha. There is a scope for increasing green fodder yield under irrigation facilities.

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Conflict of interest: None.

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