

EFFICACY OF NITROGEN ON GREEN FODDER YIELD AND QUALITY OF OAT (*Avena sativa* L.)

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ABSTRACT

An experiment was conducted at Buffalo Research Institute Pattoki to study the effect of varying levels of nitrogen fertilizer on oat fodder yield, dry matter yield and dry matter percentage. Different levels of nitrogen; T₀, O; (control) with no phosphorous and potassium, T₁ 0; T₂, 70; T₃ 92; T₄, 114; T₅, 136; T₆, 158 kg ha⁻¹ alongwith a constant dose of triple super phosphate (84 kg ha⁻¹) and potassium sulphate (62 kg ha⁻¹) were applied. Analysis of variance indicated a significant effect of nitrogen levels on all the parameters studied. Maximum fresh fodder yield (77.11 t ha⁻¹) was obtained with the application of 114 kg ha⁻¹ nitrogen. Whereas minimum fresh fodder yield (55.56 t ha⁻¹) was obtained when no fertilizer (nitrogen, phosphorous and potassium) was applied. Higher doses of nitrogen (136 or 158 kg ha⁻¹) adversely affected the fresh fodder yield.

Key words: Oat, Nitrogen level, Green fodder yield, dry matter yield, dry matter percentage.

INTRODUCTION

Importance of fodder crops in agriculture needs no emphasis because of the fact that the adequate nutritious regular fodder availability is a basic requirement for livestock production to meet the demand of milk, butter and other byproducts for human consumption. Animals in Pakistan are generally underfed, which results in unsatisfactory production of livestock. One of several reasons for low yield is low fertility status of most cultivated soils, especially nitrogen is deficient in the cultivated soils of the world (Ulysses, 1982).

The area under fodder crops is 3.35 million hectares out of a total cropped area of 21.85 million hectares in the country, producing more than 60 million tones of fodder (Anonymous, 2007). The area under fodder in Punjab is 2.03 million hectares with a total production of 45 million tones, which is not sufficient even to meet the maintenance requirements of the livestock (Anonymous, 2007). One way of improving the yield and quality of fodder crops is to determine their fertilizer requirements. The plant nutrition not only affects the forage production but also improves the quality of forage from viewpoint of its protein content. (Khandaker and Islam, 1988)

Oats (*Avena sativa* L.), locally known as javi, jai, or jodar, belong to the poaceae family. Oats is a crop of Mediterranean origin; not as old as wheat and barley, but their domestication dates back to ancient times. Oats is one of the most important cereal fodder crops grown in winter throughout Pakistan both under irrigated and rain fed conditions. Temperate and cool sub-tropical conditions are congenial for its growth. A well-

distributed rainfall of 400 mm and an optimum temperature range 16-32°C during the four months duration is sufficient to meet its requirement as a fodder crop. It is a quick growing, palatable, succulent and nutritious crop and forms an excellent combination when fed along with other cold season legumes, like berseem or Egyptian clover (*Trifolium alexandrinum*), Lucerne or alfalfa (*Medicago sativa*), Indian clover (*Melilotus indica*), Persian clover (*Trifolium resupinatum*) and pea (*Pisum arvense*), or vetch (*Vicia sativa*) (Thomson *et al.*, 1990).

The oats can provide green fodder after 60-70 days in emergency to tide over the scarcity period but after 90-100 days to get large quantity of fodder. Oats is mostly fed as green and surplus is converted into silage or hay for use during the fodder deficit periods. It is favourite feed of all animals and its straw is soft and superior to wheat and barley. It is high in TDN, protein, fat, vitamin B1 and minerals as phosphorus and iron. The oats grain is particularly valuable feed for horses, dairy cows, poultry and young breeding animals of all kinds (Hussain *et al.*, 2002).

Livestock, mainly stall-fed, are very important in Pakistan's agricultural economy. Crop residues and fodder form are the basis of the ration, with concentrates for commercial stock. Agricultural land is limited, so increased forage availability has to be through increasing yield per unit area. Introduction of the new oats cultivars coincided with expansion of dairying and gave impetus to commercial forage growing in the irrigated tracts. Therefore, to maintain production at high levels, it is important to achieve high use efficiency of chemical fertilizers through suitable application.

Present study was, therefore, planned to find out best economical dose of nitrogen fertilizer for obtaining maximum green fodder yield, dry matter yield, dry matter percentage of Oats with better nutritional quality under irrigated conditions at Buffalo Research Institute Pattoki, District Kasur.

MATERIALS AND METHODS

A field experiment to study the fodder yield and quality of oat under different nitrogen levels was conducted at Buffalo Research Institute, Pattoki District Kasur during 2007-08. The experiment was laid out in randomized complete block design (RCBD) with three replications using a net plot size of 3 x 5 m. The experiment was conducted in soil having a pH = 8.1 (alkaline in reaction), available phosphorus (7.9 ppm), available potassium (165 ppm), TSS (0.09%) and was low in organic matter (0.79 %).

The nitrogen treatments are shown in table 1. Oat was sown on November 01, 2007 on a well prepared seed bed. All necessary precautions regarding agronomic and plant protection measures were kept normal and uniform to avoid bias.

Table: 1. Nitrogen levels (kg ha⁻¹) keeping the phosphorus and potassium levels constant in all treatments.

Treatments	N (kg ha ⁻¹)	P ₂ O ₅ (kg ha ⁻¹)	K ₂ O (kg ha ⁻¹)
T ₀	0	0	0
T ₁	0	84	62
T ₂	70	84	62
T ₃	92	84	62
T ₄	114	84	62
T ₅	136	84	62
T ₆	158	84	62

Nitrogen and phosphorus in the form of urea and triple super phosphate (TSP) and potassium in the form of potassium sulphate were applied to all the treatments except control. Half dose of nitrogen with full dose of P₂O₅ and K₂O in all treatments except control was applied at the time of sowing by side dressing with the help of a hand drill. While the remaining half dose of N was applied at 1st irrigation.

1-Fresh fodder yield (t ha⁻¹): At 50 % flowering stage, all treatments of each replications were harvested and weighed to get fresh fodder yield (FFY). The yields obtained were converted into t ha⁻¹.

2-Dry matter (%): For dry matter determination, firstly aluminium containers were oven dried and weighed by electric balance. 10 g of plant sample was weighed in

each container and placed in an oven at 105 °C till constant weight was attained. Dry matter percentage was calculated by the following formula.

$$\text{Dry Matter (\%)} = \frac{\text{wt. of oven dry sample}}{\text{wt. of sample before drying}} \times 100$$

3-Dry matter yield (t ha⁻¹): Dry fodder yield (DMY) was calculated by applying this formula.

$$\text{DMY (t ha}^{-1}\text{)} = \frac{\text{FFY} \times \text{DM (\%)}}{100}$$

Analysis procedures described by A. O. A. C. (1984) were followed for the determination of crude protein, crude fibre, ether extractable fat and total ash percentage. The data thus recorded were subjected to statistical analysis under Complete Randomized Block Design through analysis of variance technique. The differences among treatment means were tested by applying Duncan's Multiple Range Test (Steel *et al.*, 1997) and economic analysis of variance for nitrogen levels for interpretation of results and drawing of valid conclusion.

RESULTS AND DISCUSSION

1-Fresh fodder yield (t ha⁻¹): The data regarding influence of different nitrogen levels on total green fodder yield are depicted in Table-2. The data indicated that nitrogen levels showed significant effect on green fodder yield. The minimum green fodder yield (55.56 t ha⁻¹) was obtained where no nitrogen was applied. The green fodder yield increased with each increase in nitrogen level.

Table-2: Effect of different doses of nitrogen fertilizer on the Green Fodder yield, Dry matter Yield (t ha⁻¹) Dry matter Percentage respectively.

Treatments	Fresh Fodder Yield (t ha ⁻¹)	Dry Matter Yield (t ha ⁻¹)	Dry Matter (%)
T ₀	55.56	15.18	27.38
T ₁	59.11	15.79	26.72
T ₂	66.22	16.03	24.20
T ₃	72.67	19.45	26.77
T ₄	77.11	19.97	25.89
T ₅	76.89	22.01	28.63
T ₆	68.00	21.93	32.25

The maximum green fodder yield (77.11 t ha⁻¹) was obtained where nitrogen was applied @ 114 kg ha⁻¹ (T₄). Further increase in nitrogen (136 and 158 kg N) showed a negative effect on fodder yield, but also

increased economics of fertilizer. This might be due to the fact that excessive fertilization caused lodging, which reduced the yield. Significant increase in green fodder yield at T₄ can be attributed to greater plant height, number of leaves per plant and leaf area index. The present findings regarding significant effect of nitrogen level are in agreement with the results reported by Mahale *et al.*, (2003) and Johnston *et al.* (2004).

2-Dry fodder yield (t ha⁻¹): From the data presented in Table-2 indicate that nitrogen levels showed significant effect on dry fodder yield. All the treatments differed significantly with one another. All the nitrogen levels produced relatively higher dry fodder yield than control. Maximum dry fodder yield (22.01 t ha⁻¹) was observed in treatment receiving 136 kg N ha⁻¹ (T₅) while minimum dry fodder yield (15.18 t ha⁻¹) was observed in treatment getting no nitrogen fertilizer (T₀). The findings of the present study regarding significant effect of nitrogen on dry fodder yield were reported by Hasan and Shah (2000).

3-Dry Matter (%): As crops grow towards maturity, dry matter percentage increase with a simultaneous decrease in moisture percentage, being a natural trend. The data presented in Table-2 revealed that dry matter percentage showed the significant effect with the application of nitrogen fertilizer. Maximum dry matter percentage (32.25 %) was obtained when crop was fertilized @ 156 kg N ha⁻¹ (T₆). An increase in dry matter percentage with nitrogen application has also been reported by Wang *et al.* (2002).

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