

PERFORMANCE OF FORAGE YIELD AND ECONOMICS OF OAT (*AVENA SATIVA* L.) VARIETIES UNDER DIFFERENT NITROGEN LEVELS IN CENTRAL INDIA

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Abstract: A field experiment was conducted at Instructional cum Research Farm, Indira Gandhi Krishi Vishwavidyalaya, Raipur during *Rabi* season of 2007 to study the “Performance of forage yield and Economics of Oat varieties under different nitrogen levels in central India” has been taken up with objectives of effect of nitrogen on forage yield and economics of oat, performance of different genotype of oat & interaction effect of nitrogen and genotype of oat.. The experiment was laid out in Factorial Randomized Block Design with three replications. The treatments were allotted to different plots by using random method. Different varieties of oat viz. UPO-2005-1(V₁), NDO-1(V₂), Kent (SC) (V₃) and OS-6 (SC) (V₄) and four levels of nitrogen viz. 0 kg ha⁻¹ (N₁), 40 kg ha⁻¹ (N₂), 80 kg ha⁻¹ (N₃) and 120 kg ha⁻¹ (N₄) are two factors were kept under different treatment combinations. The growth and yield attributes, like plant population, tillers, leaf stem ratio, fresh & dry forage yield were superior under Kent (SC) (V₁) variety and 80 kg nitrogen ha⁻¹. While, there attributes were registered superior with UPO-2005-1(V₁) variety of oat and 120 kg ha⁻¹ (N₄) as compared to oat varieties and different nitrogen levels. Among different varieties of oat, Kent (SC) fetched maximum net profit (Rs. 8584.37 ha⁻¹) and B: C ratio (0.95) while NDO-1 variety could bring lowest in net profit and B: C ratio. Among different levels of Nitrogen, application of Nitrogen @ 120 kg ha⁻¹ recorded highest net return (10558.12), but highest B: C ratio (1.14) was obtained in 80 kg N ha⁻¹. Maximum net profit (Rs 11405.50 ha⁻¹) and B: C ratio (Rs 1.21 Rp⁻¹ invested) was obtained in V₃N₄ (Kent (SC) + Nitrogen @ 120 kg ha⁻¹) treatment combination followed by V₁N₃ (UPO-2005-1 + Nitrogen @ 80 kg ha⁻¹) (Rs 11148.50 ha⁻¹) and B:C ratio (Rs 1.23), respectively, while it was found lowest under V₂N₁ (NDO-1+ Nitrogen @ 0 kg ha⁻¹) treatment combination.

Keywords: Nitrogen levels, forage yield, varieties and Economics of Oat

INTRODUCTION

Oat (*Avena sativa* L.) is one of the most winter fodder crop. It containing 10-12 per cent protein and 30-35 per cent fibre, rich in fat, vitamin B₁, phosphorus and iron (Mehra, 1978). Agriculture and Animal husbandry is complementary enterprises and it plays a vital role in Indian economy. Animal husbandry output constitutes about 30 per cent of the country's agriculture output (Anonymous, 2007, pp. 1128). Winter fodder oat is good for milch and draft cattle and important annual forage crop in areas having limited irrigation facilities due to quick regrowth habit, good quality forage, better palatability and high tonnage. Therefore, there is a need to boost the production of green and dry fodder yield. So far no studies have been taken upto explore the production potential of oat under the agro-climatic condition of Chhattisgarh plains. Many high yielding varieties of oat have been developed which needs to be tested after the harvest of rice for enhancing the cropping intensity of Chhattisgarh besides providing good quality forage to the animals. Nitrogen is one of the essential plant nutrient and is the most limiting nutrient in Indian soil. The key function of nitrogen is to increase the vegetative growth and boost up the regrowth after cutting in forage production. The major portion of nitrogen taken by the plant is used in synthesizing protein. Oat being graminaceous species requires heavy dose of fertilizer nitrogen for producing high quality herbage.

MATERIAL AND METHOD

A field experiment was conducted at Instructional cum Research Farm, Indira Gandhi Krishi Vishwavidyalaya, Raipur during *Rabi* season of 2007. The soil of the experimental field was clayey in texture locally known as *Matasi* (Inceptisol). The soil was Inceptisol in texture with pH 7.6. Fertility status of soil was categories as low nitrogen (208.52 kg ha⁻¹) and medium phosphorus (13.20 kg ha⁻¹) and high in potassium (314.50 kg ha⁻¹), EC (0.13 dsm⁻¹ at 25°C), organic carbon 0.36%, permanent wilting point (17.5 %), water holding capacity (39.48 %) and bulk density (1.4 Mg m⁻³). The experiment was laid out in Factorial Randomized Block Design with three replication. The treatments were allotted to different plots by using random method. Different varieties of oat (*Avena sativa* L.) viz. UPO-2005-1(V₁), NDO-1(V₂), Kent (SC) (V₃) and OS-6 (SC) (V₄) and four levels of nitrogen viz. 0 kg ha⁻¹ (N₁), 40 kg ha⁻¹ (N₂), 80 kg ha⁻¹ (N₃) and 120 kg ha⁻¹ (N₄) are two factors were kept under different treatment combinations. The treatments were allotted to different plots by using random methods. Raipur, the capital of Chhattisgarh state comes under dry sub humid to semi dry agro-climatic zone, receiving an average rainfall of 1150 mm rainfall annually out of which about 88% is received during the rainy season (June to September) and the rest 12% during winter season (October to February). The maximum temperature goes as high as 45°C during summer months and minimum as low as 6 °C during winter months. The temperature ranged between 15.4 to 29.8 °C during the sowing week, which favored

germination and plant establishment. The temperature ($18-21^{\circ}\text{C}$) was quite favorable during vegetative growth of crop (Chatterjee and Das, 1989). The highest relative humidity varying between $85.8 - 92$ per cent was also favorable for vegetative growth of the crop. Relative humidity is high from June to October and shows a declining trend there after with an absolute minimum during peak winter (January). The crop growth period received only 19.2 mm total rainfall. The maximum mean temperature for different months varied from $24.4-31.2^{\circ}\text{C}$. The relative humidity was varying from $74-93$ percent. Thus; weather ingredients were favorable during crop growth period. The open pan evaporation value ranged from 2.1 mm to 4.4 mm day^{-1} . The maximum sunshine hours was 9.5 hour day^{-1} in third standard metrological week of January and minimum 2.3 hours day^{-1} in first week of February. Observation on plant population, dry weight of plant, L: S ratio, were recorded at different growth stages. Yield and yield attributing character were statistically analyzed. Finally economics were also worked out. Sorghum-Berseem-Sorghum cropping sequence was followed in the experimental field since last two year. It is obvious that Sorghum was taken as main crop in *Kharif* season followed by Berseem in *rabi*. The recommended levels of fertilizers along with their agronomic practices were in general adopted on the crop during the past two years for forage crop production. Oat seeds @ 90 kg ha^{-1} were sown apart from 25 cm row distance. In all the treatments, to maintain uniform plant population gap filling was done at 10 days after sowing. The required quantity of fertilizer was carried out as per the treatments. Urea and single super phosphate were used as the source of N and P respectively. Full dose of phosphorus was applied as basal and nitrogen was applied through urea as per levels of particular treatments in two split first 50 per cent at 25 DAS. Traditionally weed management techniques was adopted for weed management. Hand weeding was done manually at 20 and 45 DAS, to avoid the weed growth in the field. After sowing, immediately light irrigation were applied through border strip method. Subsequent irrigation was given at an interval of 20 days for proper growth and development of the crop. After cutting light irrigation was applied essentially. The plant population was counted with the help of 50×50 cm quadrat placing at five places for each plot.

RESULT AND DISCUSSION

Plant population (m^{-2}), Tillers m^{-1} row length & Green fodder yield (q ha^{-1})

The data showing the effect of different treatment on plant population (m^{-2}) are presented in table 3. Plant population did not differ significantly by any of the treatments. On an average, 200 plant m^{-2} were recorded under all treatments at 20 DAS. Thus, the plant population was uniform in all the plots under

study. This might be due to fact that gap filling was done after 10 days of sowing to maintain desire plant population per unit area.

The effect of various treatments on tillers m^{-1} row length & Green fodder yield (q ha^{-1}) in fodder oat are presented in table. It is evident from the table that tillers m^{-1} row length & Green fodder yield in forage oat were significantly affected by various treatments. Perusal of mean value from table indicated that amongst varieties, variety Kent (SC) (V_3) recorded significantly higher number of tiller m^{-1} row length & Green fodder yield which was at par with the value of variety UPO-2005-1 (V_1). Lowest number of tiller m^{-1} row length was recorded in NDO-1(V_2) variety. Application of Nitrogen @ 120 kg ha^{-1} (N_4) recorded significantly higher number of tiller m^{-1} row length & Green fodder yield followed by application of nitrogen @ 80 kg ha^{-1} (N_3) which were statistically on par. The lowest number of tiller m^{-1} row length & Green fodder yield recorded under control plot (0 kg N ha^{-1}). Among interaction effect of varieties and nitrogen levels, V_3N_4 ((Kent (SC) + Nitrogen @ 120 kg ha^{-1}) recorded highest number of tiller m^{-1} row length & Green fodder yield (417.33 q ha^{-1}), followed by V_1N_4 (UPO-2005-1 + Nitrogen @ 120 kg ha^{-1}) and V_3N_3 ((Kent (SC) + Nitrogen @ 80 kg ha^{-1}). The lowest number of tiller m^{-1} row length & Green fodder yield (190.03 q ha^{-1}) were recorded under V_2N_1 (NDO-1+ Nitrogen @ 0 kg ha^{-1}). Tillers m^{-1} row length & Green fodder yield were increased with increased levels of nitrogen, this might be due to higher uptake of Nitrogen by plant. Rana *et al.* (2002) opined that number of tillers m^{-1} row length of oat crop increased significantly with each increment of 40 kg N from $0-120$ kg N ha^{-1} over the preceding one. Green forage yield one of the possible reason for favourable influence of increasing dose of nitrogen on yield attributes might be due to increased plant height and leaf thickness compared to no nitrogen. Chlorophyll effect might have resulted in higher green forage yield due to nitrogen fertilization. Raja *et al.* (2000) also reported that forage yield and quality yield were better with higher nitrogen levels.

Dry matter yield (q ha^{-1}) & Leaf: stem ratio

Among different varieties of oat, variety Kent (SC) (V_3) recorded significantly higher dry matter yield & Leaf: stem ratio of oat as compared to other varieties. However it was on par with the value of variety UPO-2005-1 (V_1). The lowest dry matter yield & Leaf: stem ratio were associated with variety NDO-1(V_2). Application of different levels of nitrogen significantly affected the dry matter yield & Leaf: stem ratio of oat and the response of application of different levels of nitrogen was linear. Among different levels of nitrogen, application of Nitrogen @ 120 kg ha^{-1} (N_4) recorded significantly higher DMY & Leaf: stem ratio of oat which was at par with DMY recorded by application of Nitrogen @ 80 kg ha^{-1} (N_3). Interaction effect of varieties and nitrogen levels

significantly affected the dry matter yield & Leaf: stem ratio of oat, combine effect of V_3N_4 ((Kent (SC) + Nitrogen @ 120 kg ha⁻¹) produced significantly higher dry matter yield & Leaf: stem ratio over other treatment combination followed by V_1N_4 (UPO-2005-1 + Nitrogen @ 120 kg ha⁻¹). The lowest dry matter yield & Leaf: stem ratio were recorded under V_2N_1 (NDO-1+ Nitrogen @ 0 kg ha⁻¹) treatment. This might be due to improved nutrients availability, physico-chemical and biological properties of soil, promoted accumulation of carbohydrate resulting in higher green fodder yield and dry matter content in plant, ultimately leading to higher dry matter yield & Leaf: stem ratio of oat. Pathan *et al.* (2007) also reported that the application of 120 kg nitrogen ha⁻¹ gave significantly higher green forage (569.99 q ha⁻¹) and dry matter yield (117.34 q ha⁻¹) than all other nitrogen levels. Shah *et al.* (1999) found that var. SK 0-7 recorded maximum leaf: stem ratio with two cuts (single cut autumn crop followed by double (autumn+ spring) cut crop and spring harvested crop).

Economics

Economics of various treatments with fodder oat crop was calculated and the results are summarized in table 4.16 and depicted through fig. 4.15. The net return (Rs. 8580.25) and B: C ratio (0.95) was highest in variety Kent (SC) (V_3). However, variety UPO-2005-1 (V_1) recorded higher net return and B: C ratio as compared to V_2 (NDO-1) and V_4 (OS-6 (SC)). The net return (Rs 10558.12) was highest in N_4 (120 kg N ha⁻¹) but approximately at par with the net return (Rs 10318.5) of N_3 (80 kg N ha⁻¹) and B: C ratio (1.14)

was highest in N_3 (80 kg N ha⁻¹) among different nitrogen levels. In different combination of varieties and nitrogen levels, V_3N_4 (Kent (SC)+ Nitrogen @ 120 kg ha⁻¹) recorded highest net return (Rs. 11405.50) and highest B:C ratio (1.23) was in V_3N_3 (Kent (SC) + Nitrogen @ 80 kg ha⁻¹). In forage crop, total dry matter production in a plant after reflects its potentiality for its biomass production which is directly related to its economic value. The highest gross and net returns were due to highest forage yield. The benefit: cost ratio was highest due to the sustainability in increased yield and decrease cost of cultivation. Cutting of the oat crop for forage at 85 days after sowing gave 7.5 and 34.0 per cent high Observation on plant population, plant height, fresh weight of plant, dry matter accumulation (g plant⁻¹), dry weight of plant, L: S ratio, N content in plant and Crude Protein content were recorded at different growth stages. Yield and yield attributing character were statistically analyzed. Sharma *et al.* (2004) observed that From the economic point of view, the highest net return per rupee invested (Rs. 1.58 ha⁻¹) was obtained in the treatment T_{10} {50 per cent recommended dose of fertilizer + Vermicompost @2.5 tonnes ha⁻¹+ FYM @2.5 tonnes ha⁻¹} followed by T_8 (Rs. 1.55 ha⁻¹) receiving 50 per cent recommended dose of fertilizer (RDF) + Vermicompost @ 2.5 tonnes ha⁻¹. In a nutshell, considering the yield and economics, application of 50 per cent recommended dose of fertilizer (RDF) + Vermicompost @ 2.5 tonnes ha⁻¹ +FYM @ 2.5 tonnes ha⁻¹ was found to be the best among all the treatments.

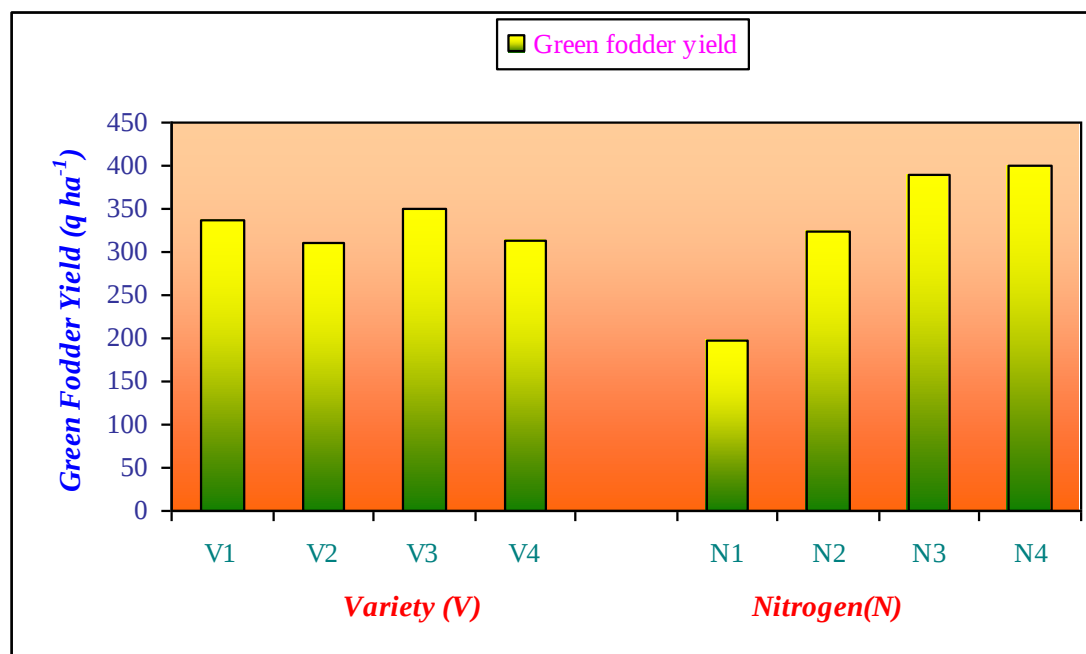


Fig 1: Green fodder yield (q ha⁻¹) as influenced by various treatments

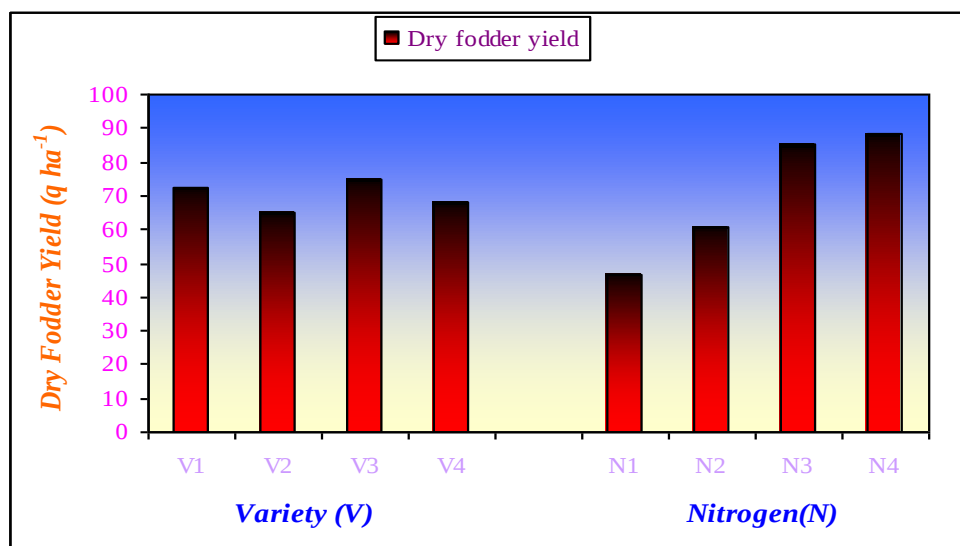


Fig 2: Dry fodder yield (q ha⁻¹) as influenced by various treatments

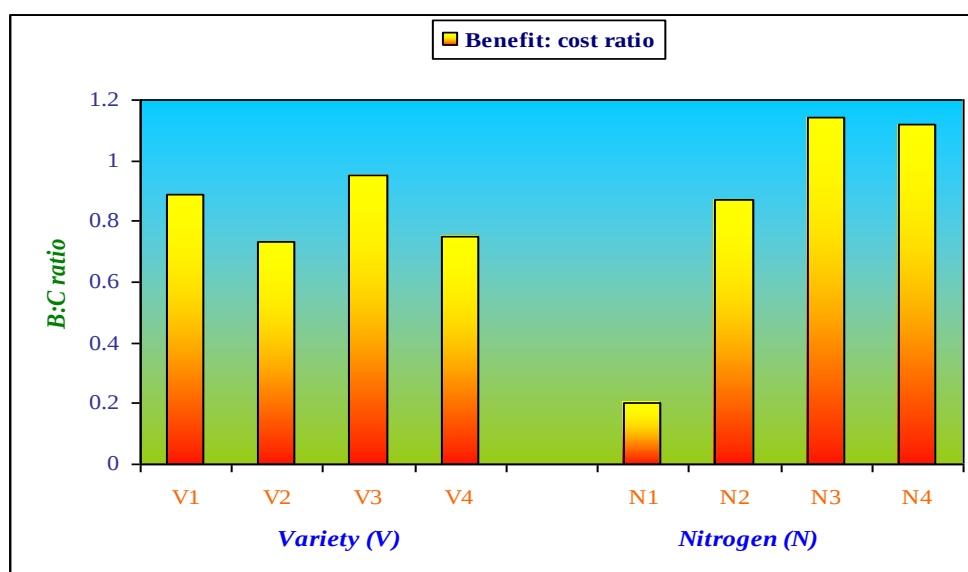


Fig 3: benefit cost ratio as influenced by various treatments

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