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Short Communication

To study the effect of nitrogen on growth of oat (*Avena sativa* L.)

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Abstract
Agriculture and Animal husbandry is complementary enterprises and it plays a vital role in Indian economy. All India summary reports of the 17th livestock census released in July 2006 points out that India possesses the largest livestock populations in the world after Brazil. It accounts for about 56 per cent of the world's buffalo population and 14 per cent of the cattle population. It ranks first in respect of buffalo and second in respect of cattle population, second in goat population and third in respect of sheep in the world. Animal husbandry output constitutes about 30 per cent of the country's agriculture output (*Indian Economy*, 2007, pp. 23). At present, the productivity of existing stock of cattle and buffaloes is very poor which can be increased if they are fed with balance and adequate quantity of quality fodder and feeds (Singh and Singh, 2002). Inspite of that we are highly deficient in various livestock products, though we have about one-fourth of the total cattle population of the world. The analysis of this situation reveals that one of the main reasons for the low productivity of our livestock is malnutrition, under-nutrition or both, besides the low genetic potential of the animals.

Keywords: Animal husbandry, fodder, feeds, genetic potential and malnutrition

Introduction
Agriculture and Animal husbandry is complementary enterprises and it plays a vital role in Indian economy. All India summary reports of the 17th livestock census released in July 2006 points out that India possesses the largest livestock populations in the world after Brazil. It accounts for about 56 per cent of the world's buffalo population and 14 per cent of the cattle population. It ranks first in respect of buffalo and second in respect of cattle population, second in goat population and third in respect of sheep in the world. Animal husbandry output constitutes about 30 per cent of the country's agriculture output (*Indian Economy*, 2007, pp. 23) [3].

At present, the productivity of existing stock of cattle and buffaloes is very poor which can be increased if they are fed with balance and adequate quantity of quality fodder and feeds (Singh and Singh, 2002) [9].

Inspite of that we are highly deficient in various livestock products, though we have about one-fourth of the total cattle population of the world. The analysis of this situation reveals that one of the main reasons for the low productivity of our livestock is malnutrition, under-nutrition or both, besides the low genetic potential of the animals.

Chhattisgarh state is rich in livestock resources having the total population of cattle, buffalo, sheep and goat is 8154673, 1887194, 206484 and 2125317 respectively. The total pasture area is about 855300 ha and forage & fodder area is about 306 ha (Krishi Sankhyiki Sarini, C.G. Govt., 2006) [1]. But the production is only thousand metric tonnes with per capita availability of 72.06 ml, which is very low than the recommended quantity (220 g) by Indian Council of Medical Research (Chhattisgarh at glance 2001). The productivity of animal in Chhattisgarh is quit low in comparison to other states of the country. It has been observed that improvement of genetic make up of animal could only contributes up to 30 per cent to production and rest 70 per cent is depends on environment like proper nutrition, management and health cover (Singh and Singh, 2002) [9]. The unavailability of sufficient quantity of green fodder through the year in the state is the major constrain in the development of animal husbandry. The major part of livestock forage resources in Chhattisgarh is met either from byproduct (wheat, rice straw /crop residues) or form the less nutritious grasses leading to low production and productivity

of live stock feeding of livestock with roughs increases the farmer makes it less feasible. Nitrogen is one of the essential plant nutrients 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. It is efficient nitrogen user among cereals. The response for nitrogen maximizing forage production per unit area per unit time is lacking in Chhattisgarh state.

Materials and Methods

A Field experiment was conducted to evaluate "To Study the effect of Nitrogen on growth of Oat (*Avena sativa* L.)." This chapter deals with the concise description of the materials used and the experimental techniques adopted during the course of investigation.

i) Experimental site

The experiment was conducted during *rabi* season at the Instructional Farm, Indira Gandhi Krishi Vishwavidyalaya, Raipur (C.G.).

ii) Geographical situation

Raipur is situated in the plain region of C.G. state and lies at 21^0 16' North Latitude and 81^0 36' East Longitude at an altitude of 298.56 meters above the mean sea level (MSL).

iii) Experimental details

The experiment was laid out in Factorial Rendomized 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(V_1), NDO-1(V_2), Kent (SC) (V_3)and OS-6 (SC) (V_4) and four levels of nitrogen *viz*. 0 kg ha^{-1} (N_1), 40 kg ha^{-1} (N_2), 80 kg ha^{-1} (N_3) and 120 kg ha^{-1} (N_4) are two factors were kept under different treatment combinations.

iv) Plan and layout of the experiment

The treatments were randomly allotted as per detailed layout plan of the experiment.

Table 1: Detail of experiment

Factor A	**Factor B**
Varieties of oat crop	**Levels of Nitrogen (**kg ha^{-1}**)**
UPO-2005-1	0
NDO-1	40
Kent (NC)	80
OS-6 (NC)	120

Table 2

Particular	**Detail**
Design	Factorial Randomized Block Design
Number of treatment	Sixteen
Number of replication	Three
Total number of plots	Fourty-eight
Dose of fertilizer	N as per treatments 60 kg P_2O_5 ha^{-1}
Spacing between	
A] Replication	1.0 m
B] Plot	0.5 m
C] Row	25 cm
Net plot size	3.50 m X 2.50 m = 8.75 m^2
Gross plot size	4.0 m X 3.0 m = 12.00 m^2
Gross experimental area	55.5 m X 14.0 m = 777 m^2
Date of sowing	07-12-2007
Date of harvesting	20-02-2008

v) Test crop

Oat (*Avena sativa* L.) cultivar *viz*. UPO-2005-1(V_1), NDO-1(V_2), Kent (SC) (V_3)and OS-6 (SC) (V_4) were taken as test crop.

vi) Fertilizer Application

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 and 50 per cent at 50 DAS. Details of fertilizer dose were given below:

For each varieties of oat (UPO-2005-1, NDO-1, Kent (NC) and OS-6 (NC)} recommended dose of fertilizers are:

N_1 - Nitrogen @ 0 kg ha^{-1} + SSP @ 60 kg ha^{-1}
N_2 - Nitrogen @ 40 kg ha^{-1} + SSP @ 60 kg ha^{-1}
N_3 - Nitrogen @ 80 kg ha^{-1} + SSP @ 60 kg ha^{-1}
N_4 - Nitrogen @ 120 kg ha^{-1} + SSP @ 60 kg ha^{-1}

vii) Crop growth rate (CGR) (g plant $^{-1}$ day $^{-1}$)

The crop growth rate indicates the growth of crop plants in g day^{-1} $plant^{-1}$. The CGR was calculated with the help of following formula:'

$$\text{CGR (g day}^{-1}\text{ plant}^{-1}) = \frac{W_2 - W_1}{t_2 - t_1}$$

Where,

W_2 and W_1 = Difference in oven dry biomass at the time interval

$t_2 - t_1$ = Time interval in day

Results and Discussion

The results obtained during course of investigation are presented below. The results are discussed here in the light of scientific reasoning to understand the cause and effect relationship. Vegetative part of the plant is considered as forage crop.

A field experiment was carried out during *Rabi* season to study the "To study the effect of nitrogen on the growth of Oat (*Avena sativa* L.)."

1) Plant population (m^{-2})

Data recorded on plant population showed that on an average 200 plants m^{-2} were recorded under all treatments at 20 DAS.

At 20 DAS, oat plants give significantly higher plant population with variety Kent (SC) (V_3) than NDO-1(V_2) and OS-6 (SC) (V_4) variety, but it was at par with UPO-2005-1 variety (V_1).

It was observed that plant population was higher with the application of 80 kg N per ha. (N_3) over other doses at all stages of observation, but it was at par with 120 kg N per ha. (N_4), obviously lowest plant population was noted under 0 kg N per ha. (N_1).

Interaction effect of varieties and nitrogen levels was also significant with respect to plant population at 20 DAS. V_1N_4 (UPO-2005-1 + Nitrogen @ 120 kg ha^{-1}) treatment recorded maximum plant population followed by V_3N_4 ((Kent (SC) + Nitrogen @ 120 kg ha^{-1}). Lowest plant population was recorded in V_2N_1 (NDO-1+ Nitrogen @ 0 kg ha^{-1}) plot.

2) Growth parameters

i) plant height (cm)

The data on plant height were recorded at 20, 40, 60 DAS, plant height increased with the advancement of crop age up to harvest.

At 20, 40, 60 DAS and at harvest, oat plants give significantly taller with variety Kent (SC) (V_3) than NDO-1(V_2) and OS-6 (SC) (V_4) variety, but it was at par with UPO-2005-1 variety (V_1). Amongst different doses of nitrogen, N_3 (80 kg N ha^{-1}) recorded significantly taller plant over other doses, but it was at par with N_4 (120 kg N ha^{-1}).

The interaction effect was found non significant at 20, 40 and 60 DAS but at harvest stage interaction effect was found significant difference. However at this stages, interaction were also noted to vary significantly, giving tallest plant under V_3N_3 (Kent (SC) + Nitrogen @ 80 kg ha^{-1}) and shortest V_2N_1 (.NDO-1+ Nitrogen @ 0 kg ha^{-1}).

Tiwari *et al*. (1980) [10] observed that forage sorghum responded well to nitrogenous fertilizer as the nitrogen has the quickest and most pronounced effect on the vegetative growth. Singh and Singh (1983) [8] also reported similar findings. Poonia *et al.* (1999) [5] observed that plant height increased upto 80 kg nitrogen ha^{-1} while number of green leaf $plant^{-1}$ at harvest increased with increasing nitrogen rate. Joon *et al.* (1989) [4] also reported similar findings.

Qamar *et al*. (2006) [7] reported that cultivars Jasper and Scott produced significantly taller plants than other varieties. The tallest plants (130-cm) were produced by Jasper followed by Scott (126.6 cm). The check variety Local D. I. Khan had 111.6 cm plant height. Minimum plant height (111.3 cm) was produced by variety No. 677 of oat.

ii) Crop growth rate (g $plant^{-1}$ day^{-1})

The crop growth rate was influenced significantly due to various treatment at 40, 60 DAS and at harvest.

The data shown that oat plants give significantly higher crop growth rate with variety Kent (SC) (V_3) than NDO-1(V_2) and OS-6 (SC) (V_4) variety, but it was at par with UPO-2005-1 variety (V_1).

The mean value revealed that CGR during 20 to 40 DAS, 40 to 60 DAS and 60 DAS to harvest. Significantly influenced by various level of nitrogen application. Nitrogen application @ 80 kg ha-1 (N_3) recorded highest CGR. Lowest CGR was recorded under 0 kg N ha^{-1} (N_1).

Among interaction, V_3N_3 (Kent (SC) + Nitrogen @ 80 kg ha^{-1}) recorded significantly higher CGR over other treatment combination during 20-40 DAS and 40 to 60 DAS. Lowest value of CGR was obviously recorded with V_2N_4 (NDO-1+ Nitrogen @ 120 kg ha^{-1}).At 60 DAS to harvest, CGR recorded lowest compared to 20 to 40 DAS and 40 to 60 DAS.

Pradhan and Mahapatra (1995) [6] found that application of nitrogen up to 120 kg ha^{-1} observed that highest crop growth rate (17.94 and 11.1 g m^{-2} day^{-1}) was recorded at 25-35 DAS and 35-45 DAS in 1987-88 and 1988-89, respectively.

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