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NITROGEN AND PHOSPHORUS: IMPACT ON FORAGE OAT (*Avena sativa* L.) GROWTH, YIELD AND ITS QUALITY ATTRIBUTES

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A field trial was carried out to examine the comparative efficacy of organic and inorganic sources of nitrogen and phosphorous fertilizers alone and in different combinations on yield and quality contributing factors of oat (*Avena sativa* L.) during 2008-09. The experimental treatments as T_1 (control), T_2 ($N:P_2O_5$ @ 150:60 kg ha^{-1}, T_3 (farm yard manure @ 4000 kg ha^{-1}), T_4 (poultry manure @ 3000 kg ha^{-1}), T_5 ($N:P_2O_5$ + poultry manure @ 112:45 + 750 kg ha^{-1}), T_6 ($N:P_2O_5$ + farm yard manure @ 112:45 + 1000 kg ha^{-1}), T_7 ($N:P_2O_5$ + poultry manure @ 37.5:15 + 2250 kg ha^{-1}), T_8 ($N:P_2O_5$ + farm yard manure @ 37.5:15 + 3000 kg ha^{-1}) were laid out in randomized complete block design (RCBD) in triplicate run. Statistically maximum plant height (146.3 cm), number of leaves $plant^{-1}$ (6.867), number of tillers $plant^{-1}$ (8.023), number of tillers m^{-2} (336), leaf area $plant^{-1}$ (128 cm^2), fresh weight per tiller (30.1g), dry weight per tiller (5.01 g) and green fodder yield (74.67 t ha^{-1}) were recorded in inorganic fertilizers providing nutrients in sufficient amount for the growth, yield and quality parameters as compared to control, organic manures and combinations of inorganic and organic fertilizers. Contribution of organic manures was also statistically significant when compared with control, but lower than the inorganic fertilizers recommended dose alone. Also inorganic sources ($N:P_2O_5$ @ 150:60) responded well for maximum crude protein (10.76%), crude fibre (37.00%) and ash (15.14%) contrast to other treatments. Combinations of organic manure and mineral fertilizer T_5 (N: P_2O_5 @ 112:45+ Poultry manure @ 750 kg ha^{-1}) and T_6 (N: P_2O_5 @ 112:45 + Farm yard manure @ 1000 kg ha^{-1}) showed significantly greater influence than other combinations and organic manure alone.
Keywords: Forage oat, crude protein, organic manures, nitrogen, phosphorus, *Avena sativa* L.

INTRODUCTION

Oat (*Avena sativa* L.) is one of the important cereal forages grown in winter throughout the Pakistan. It is adapted to a wide range of soil types, altitude and rainfall conditions. It can tolerate waterlogged conditions better than most of others cereals (Alemayehu, 1997). Bhatti (1992) reported that fodder production is approximately 52-54 percent less then the actual requirement of Pakistan.
The unsatisfactory crop yield is due to many constrains, among those appropriate nutrient supply is important (Oad *et al*., 2004). Bending *et al*. (2002) concluded that crop residues and soil organic matter both can affect the diversity of soil microbial community and increase crop growth and yield. Organic sources like farm yard manure (FYM), poultry manure (PM), green manuring and compost etc not supply the organic matters but also increase the fertility status of soil (Change *et al*., 1991; Brady, 1996; Chung *et al*., 2000; Keupper and Gegner, 2004). Manures not only supply the important nutrients but also improve physical and chemical properties of the soil (Sharpley *et al*., 2004). Chemical fertilizers being crucial input for improving soil fertility have become an integral part of modern technology for crop production. More P availability in soil improves water use efficiency (Hayyat and Ali, 2010).There is no substitute of chemicals fertilizers (NFDC, 1997). The integration of organic and inorganic sources of nutrients not only supplied essential nutrients but also increase the fertilizer use efficiency and thereby reduce environment hazards (Ahmad *et al*., 1996). Combined use of FYM and inorganic fertilizers maintains crop yield under continuous cropping (The World Bank, 1999).
Keeping in view the above facts and for further confirmation, the study was executed to evaluate the impact of organic and inorganic sources of fertilizers on growth, yield and quality of oat fodder under Faisalabad conditions.

MATERIALS AND METHODS

***Site and soil description*:** The study to estimate the effect of organic and inorganic sources of fertilizers on growth and yield of forage oat was executed at the Agronomic Research Area, University of Agriculture, Faisalabad during 2008-09. The experimental site was situated by 73° 06′ E, 31^0 26′ N and at altitude of 184.4m above sea level with semi-arid climate. Before sowing the crop the experimental soil was analyzed for their physico-chemical properties. Soil was sandy clay loam having pH 7.8, soil organic matter 0.65%, total nitrogen 0.033 mg kg^{-1}, available phosphorus 8.8 mg kg^{-1} and available potassium 175 ppm.

***Treatments and experimental design*:** The experiment comprised of eight treatments of organic and inorganic sources of nitrogen and phosphorus alone and in different combinations, which were arranged in randomized complete block design (RCBD) with three replicates (Table 1). A net plot size of 1.8 m × 3.0 m was maintained for each treatment.

Table 1. List of organic and inorganic sources of nitrogen and phosphorus used during 2008-09

Treatments	Rate (kg ha^{-1})
T_1 = Control (no fertilizer)	--
T_2 = $N:P_2O_5$	150:60
T_3 = Farm yard manure	4000
T_4 = Poultry manure	3000
T_5 = $N:P_2O_5$ + Poultry manure	112:45 + 750
T_6 = $N:P_2O_5$ + Farm yard manure	112:45 + 1000
T_7 = $N:P_2O_5$ + Poultry manure	37.5:15 + 2250
T_8 = $N:P_2O_5$ + Farm yard manure	37.5:15 + 3000

***Crop husbandry*:** Recommended fodder oat variety Oat-2000 was sown (60 kg ha^{-1}) on 20 cm spaced rows with single row hand drill. Full dose of well rotted FYM and poultry manure were added three weeks before sowing and thoroughly mixed in the soil of respective plots according to the layout. Similarly full dose of phosphorus and half dose of nitrogen were added in the soil as urea and diammonium phosphate in the respective plots before sowing and the remaining half nitrogen at the time of first irrigation. All other agronomic practices were kept normal and uniform for all the treatments.

***Data recording and procedure*:** Observations recorded during the study period were germination count (m^{-2}), number of tillers per plant, number of tillers at harvest (m^{-2}), plant height at harvest (cm), number of leaves per tiller at harvest, leaf area per plant (cm^2) at harvest, fresh weight per tiller (g), dry weight per tiller (g), total forage yield at harvest (t ha^{-1}), crude protein (%), crude fiber (%) and ash (%). Five rows from each plot were randomly selected and then numbers of plants were counted from one-meter length of each row with the help of a meter rod. Three samples were taken from each plot then their means was taken. Ten randomly selected plants from each plot of each replication were taken and number of tillers per plant was counted and their averages were worked out. Five rows from each plot were randomly selected and then numbers of tillers were counted from one meter length of each row with the help of a meter rod. Three samples were taken from each plot then their means were taken. Ten plants were selected randomly from each plot and plant height was measured from the soil level to the highest leaf tip with the help of meter tape and their averages were worked out. The number of leaves was counted from ten randomly selected tillers from each plot of each replication, and then averages were computed out. All the leaves of already selected plants were removed and their weight was recorded separately. Then 10 gram samples were taken from the leaves of selected plants from each plot and leaf area was measured with the help of leaf area meter. The leaf area of the selected plants from each plot was calculated on weight basis and then leaf area per plant was calculated by working out averages. Ten randomly selected tillers from each plot of each replication were chopped, weighed and calculated fresh weight per tiller. The same samples used for fresh weight per tiller were air dried for 5 days. Half-kilogram samples was taken from each treatment and dried in an oven at 80°C for 24 hours. Total oven dry weight of ten tillers for each treatment was calculated by conversion. Then averages were taken to work out dry weight per tiller. All the plants of each plot of each replication were harvested and tied into bundles and these bundles were weighed separately with spring balance to determine the total biomass per plot and yield was converted on hectare basis in tones. Quality parameters like crude protein (%), crude fiber (%), total ash (%), and dry matter (%) were determined by using the methods recommended by (AOAC, 1990). The data on growth yield and quality parameters was recorded by adopting standard procedure.

Procedures for recording quality parameters:

***Crude protein (%)*:** To determine crude protein, 1.0 g of oven dried plant material was taken, 30 ml of concentrated H_2SO_4 and 5 g digestion mixture [K_2SO_4:$CuSO_4$:$FeSO_4$ (20:2:1)] was added and then digested the material in the digestion chamber at 400°C for 2-3 hours. The digested mixture was cooled down and dilution was made with the help of distilled water in 250 ml volumetric flask. 10 ml diluted sample was taken from this dilution. Distillation was done in Kjeldahl apparatus and nitrogen evolved as ammonia was collected in a receiver containing 2% boric acid solution and mixed indicator and this was titrated against standard 0.1N H_2SO_4 till golden yellow color volume of acid use was recoded. The reading was multiplied by 6.25 to get crude protein percentage.

$$\% \text{ N} = \frac{\text{Vol. of N/10 } H_2So_4 \text{ used} \times 0.0014 \times 250 \times 100}{\text{Weight of sample} \times 10}$$

Crude protein (%) = % N × 6.25

***Crude fiber (%)*:** To determine crude fiber (%), 1.0 g of oven dried plant material was taken 250 ml beaker, added 1.25% H_2SO_4 and distilled water and made the volume up to the 200 ml then placed it on flame for 30 minutes filtered and washed. Then again added 1.25% NaOH and distilled water and made volume up to 200 ml. Heated again for 30 minutes and residues were washed and filtered again. The residues were put in a pre weighed crucible and it was placed in an oven at 105°C for drying for 24 hours. After recording the dry weight (W_1) the samples were placed in muffle furnace at 600°C till grey or white ash was obtained. Then cool it and the weight of ash (W_2) was recorded and the crude fiber % was calculated using following formula;

Crude fibre (%) = W_2 - W_1/ Sample weight × 100

***Ash (%)*:** To determine ash in a sample, weighed the oven dry crucible (W_1) and put 1.0 g oven dried sample in the crucible and then placed it in a muffle furnace 600°C till constant dry weight grey ash was obtained. Cool the residue in a desiccators and reweighed (W_2) and ash (%) was calculated as under:-

Ash (%) = W_2 - W_1/ Sample weight × 100

***Statistical analysis*:** The data collected was analyzed by using Fisher's analysis of variance technique. Individual comparison of treatments' means will be made by using least significant difference (LSD) test at 5% probability level (Steel *et al*., 1997).

RESULTS AND DISCUSSION

***Growth and yield attributes*:** In the present investigation, an attempt was made to compare the effect of organic and inorganic sources of fertilizers on the growth and yield of oat fodder (*Avena Sativa* L.). Data regarding the germination m^{-2} of oat as influenced by different source of organic and inorganic fertilizers are presented in Tables 2 and 3. The data revealed that different organic and inorganic sources of fertilizer had no significant effect on germination but it varied from 189.83-195.47. The maximum germination m^{-2} (195.47) was observed in T_2 where nitrogen and P_2O_5 was applied @ 150 and 60 kg ha^{-1} and the minimum of 189.83 m^{-2} in the treatment (control). These results are quite in line with Theodori *et al*. (2003) who concluded that application of farmyard manure had no effect on seed germination. Similarly Loecke *et al.* (2004) and Harris (1996) also endorsed that adding manure did not affect seedling emergence, but resulted in enhanced growth. Statistically the maximum number of tillers per plant (8.023) was observed in T_2 where nitrogen and phosphorous was applied @ 150 and 60 kg ha^{-1} fallowed by T_5 (N:P_2O_5 @ 112:45 + Poultry manure @ 750 kg ha^{-1}) and T_6 (N:P_2O_5 @ 112:45 + Farm yard manure @ 1000 kg ha^{-1}) having 7.893 and 7.533 number of tillers per plant respectively which were statistically at par with T_2 treatment but were significantly higher than the rest of the treatment. Though the treatment T_6 and T_7 where inorganic fertizers and organic manures were applied in combination (N:P_2O_5 @ 112:45 + Farm yard manure @ 1000 kg ha^{-1}) and (N:P_2O_5 @ 37.5:15 + Poultry manure @ 2250 kg ha^{-1}), respectively, were also statistically at par with other but significantly higher than the other treatments. While the minimum number of tillers 5.94 were observed in T_1 where no fertilizers were applied. These results coinsides with the findings of Hasan and Shah (2000) who concluded that increase in nitrogen levels increased the number of tillers per plant in oat (*Avena sativa* L). While Chellamuthu *et al*. (2000) reported that combined application of biofertilizers together with N and P fertilizers increased number of tillers per plant in bajra-napier habrid grass.

The treatment T_2 where inorganic sources of fertilizer, nitrogen and phosphorous were applied @ 150: 60 kg ha^{-1} produced statistically the maximum number of tillers 338 m^{-2} than all other treatments. While the organic sources along with inorganic fertilizers in combination (N:P_2O_5 @ 112:45 + Poultry manure @ 750 kg ha^{-1}) in treatment T_5 recorded significantly less number of tillers m^{-2} than T_2 but was statistically at par with treatment T_6 (N:P_2O_5 @ 112:45 + Farm yard manure @ 1000 kg ha^{-1}) but treatment T_5 and T_6 produced significantly higher number of tillers m^{-2} compared to rest of treatments. Statistically the minimum tiller 277 m^{-2} were observed in the control treatment. These results are in contrast with the findings of Sasireka *et al*. (1998) who reported that organic and inorganic manures increased the number of tillers in bajra-napier. Similarly Jayanthi *et al*. (2002) also revealed that the application of combined source of organic and inorganic fertilizers recorded higher number of tillers m^{-2} in oat. Statistically the maximum plant height 146.3 cm was observed in the treatments T_2 (N:P_2O_5 @ 150:60 kg ha^{-1}) followed by T_5 (N:P_2O_5 @ 112:45 + Poultry manure @ 750 kg ha^{-1}) and T_6 (N:P_2O_5 @ 112:45 + Farm yard manure @ 1000 kg ha^{-1}) where 141.7 and 140 cm plant height was recorded respectively, but were statistically at par with each other but were significantly inferior to that of T_2 treatment and significantly higher than the rest of the treatments. While in case of control T_1 (no fertilizer) showed the minimum plant height of 116.6 cm. These findings are in contrast with the results of Zada *et al*. (2000), who reported that plant height increases with the increase in farmyard manure and nitrogen doses. Similarly Oad *et al*. (2004) also reported that maximum plant height 150.82 cm of maize fodder was recorded with application of 120 kg nitrogen + 3000 kg FYM ha^{-1} and Chellamuthu *et al*. (2000) that the combine application of biofertilizer together with 75% of recommended NP increase plant height compare with 100% NP alone. The results reflected in the Table 2 and 3 shows that there was a significant effect of organic and inorganic sources of fertilizers used alone are in combination on number of leaves $plant^{-1}$ at harvest. Statistically the maximum number of leaves $plant^{-1}$ (6.87) were observed in the treatment T_2 where only inorganic fertilizers nitrogen and P_2O_5 were applied at the rate of 150 and 60 kg ha^{-1} followed by T_5 (N:P_2O_5 @ 112:45 + Poultry manure @ 750 kg ha^{-1}) having (6.27) number of leaves per plant but was statistically at par with the treatment T_6 (N:P_2O_5 @ 112:45 + Farm yard manure @ 1000 kg ha^{-1}) produced 6.00 number of leaves per plant but significantly higher than rest of the treatments. While the 6.00 number of leaves per plant recorded in the treatment T_6 were also at par with treatment T_3 where only farm yard manure @ 4000 kg ha^{-1} was applied. Statistically the minimum number of leaves per plant was recorded in the treatment T_1 (control). The rest of the treatments in respect of the number of leaves per plant intermediated. The variation in number of leaves per plant may be due to the timely availability of nutrients from inorganic and organic source of fertilizers. These results are not in line with the findings of Oad *et al.* (2004) who found that number of leaves per plant was affected significantly by using varying combinations of farmyard manure and inorganic fertilizers. Similar results were also reported by Chaudhary and Khade (1991) and Randhawa *et al*. (1994).

Application of inorganic fertilizer NP at the rate of 150:60 kg ha^{-1} produced significantly gave the maximum leaf area $plant^{-1}$ (128 cm^2) than the rest of the treatments. While the treatment T_5 where combination of inorganic and organic fertilizers were applied ($N:P_2O_5$ @ 112:45 + Poultry manure @ 750 kg ha^{-1}) recorded significantly lower leaf area of 123.7 cm^2 per plant than treatment T_2 but higher than T_6, T_7 and T_8 with leaf area of 116.6 cm^2 113.5 cm^2 and 114.7 cm^2 respectively which were also statistically at par with each other but higher the control treatment which have 105.2 cm^2 leaf area per plant. The increase or decrease in leaf area per plant in different treatments may be a result of less or more number of leaves per plant and availability flow of nutrients from inorganic and organic sources of fertilizers. These results are inconsonance of the findings of Ayub *et al*. (2002) who reported that application of NP fertilizer significantly affected the leaf area $plant^{-1}$ of maize fodder. Similar results were also reported by Haq and Jan (2001) who concluded that leaf area increased with progressive increase in fertilizer level. It was evident from the data that fresh weight per tiller was affected significantly. Statistically the maximum fresh weight per tiller (30.1 g) was recorded in treatment T_2 fertilized with inorganic source ($N:P_2O_5$ @ 150:60 kg ha^{-1}) while the treatment T_5 which produced 27.30 g fresh weight per tiller where combination of inorganic and organic sources of fertilizer were used at the rate of ($N:P_2O_5$ @ 112:45 + Poultry manure @ 750 kg ha^{-1}). The minimum fresh weight per tiller (17.87 g) was recorded in T_1 where no source of fertilizer was used. The increase in fresh weight per tiller in the treatments other than control treatment with organic and inorganic fertilizers application alone and in combinations was probably due to higher number of leaves per plant, plant height and leaf area per plant. These results are not in accordance with the findings of Naterchera and Salagae (2002) who reported that fodder yield per plant of fodder maize increased with the application of cattle and chicken manure. Among the sources, recommended dose of inorganic fertilizers T_2 ($N:P_2O_5$ @ 150:60 kg ha^{-1}) produced significantly the highest dry matter per tiller (5.01 g) which was followed by T_5 (N: P_2O_5 @ 112:45+ Poultry manure @ 750 kg ha^{-1}), and T_6 (N: P_2O_5 @ 112:45 + Farm yard manure @ 1000 kg ha^{-1}) producing 4.55 and 4.36 g dry weight per tiller but were statistically at par with each other. The treatment T_3 fertilized with organic manure alone farm yard manure @ 4000 kg ha^{-1} and poultry manure @ 3000 kg ha^{-1} yielded 4.05 and 3.89 g dry weight per tiller, and were statistically at par with each other but higher than the combination of inorganic and organic sources. i.e. T_7 ($N:P_2O_5$ @ 37.5:15 + Poultry manure @ 2250 kg ha^{-1}) and T_8 ($N:P_2O_5$ @ 37.5:15 + Farm yard manure @ 3000 kg ha^{-1}) treatment producing 3.4 and 3.38 g dry weight per tiller; however, they were also statistically at par with each other. Statistically the minimum dry weight 2.97 g per tiller was recorded in the treatment, which received no fertilizer (control). These results are in agreement with Karki *et al.* (2005) who revealed that recommended dose of fertilizer on maize gave statistically the highest dry weight per plant than different combinations of fertilizer and FYM while Ogboghodo *et al.* (2004) contradictly reported that maize dry matter per plant was increased with the application of poultry manure and fertilizer. Fodder yield is a function of genetic as well as the environmental factors, which plays a vital role in plant growth and development and ultimately contributed to fodder yield. Statistically the maximum green forage yield (74.67 t ha^{-1}) was observed in T_2 ($N:P_2O_5$ @ 150:60 kg ha^{-1}) while statistically the minimum green forage yield of (38.13 t ha^{-1}) in untreated treatment T_1 (control). Next to the treatment T_2 the treatment T_6 ($N:P_2O_5$ @ 112:45 + Farm yard manure @ 1000 kg ha^{-1}) and T_5 ($N:P_2O_5$ @ 112:45 + Poultry manure @ 750 kg ha^{-1}) were statistically at par with each other and gave significantly higher green forage yield of 70 and 69 t ha^{-1} respectively compared to all other treatments. The green forage yield of other treatments was intermediated. These results are quite in line with the Ayub *et al.* (2002), who reported that NP produced significantly higher fodder yield of maize than control. Similarly Devi (2002) also reported that fodder maize variety "African Tall" produced significantly higher green fodder yield at higher dose of nitrogen while biofertilizers produced lower yield. Green fodder yield increased significantly upto 120 kg N ha^{-1}. In contrast Reiad *et al.* (1992) and Lakoo *et al.* (2004) reported that organic manures and inorganic fertilizer increase the maize fodder yield.

***Quality attributes*:** Protein content is one of the most important parameters affecting the nutritional value of fodder crops. It was evident from the data that crude protein was affected significantly by different source of fertilizers. Statistically the maximum crude protein 10.76 was produced in treatment T_2 fertilized with inorganic sources (N: P_2O_5 @ 150:60 kg ha^{-1}) followed by T_5 and T_6 treatments where combination of inorganic and organic sources of fertilizer were used @ $N:P_2O_5$, 112:45 + Poultry manure @ 750 kg ha^{-1} and $N:P_2O_5$ @ 112:45 + Farm yard manure @ 1000 kg ha^{-1} respectively. Statistically the minimum crude protein 7.74 and 8.01 were recorded in T_7 and T_8 treatments where inorganic and organic sources of fertilizers were applied @

Table 2. The mean squares of organic and inorganic sources of nitrogen and phosphorus treatments on yield and yield attributes of forage oat (*Avena sativa* L.)

SOV	df	Mean square											
		Germination count	Plant height (cm)	No. of tillers m^{-2}	No. of tillers /plant	No. of leaves /plant	Leaf area /plant	Fresh weight /tiller	Dry weight /tiller	Green fodder yield (t ha^{-1})	Crude protein (%)	Crude fiber (%)	Ash (%)
Replication	2	2.45	4.87	2.39	0.14	0.02	4.43	0.06	0.01	0.58	0.06	1.11	0.16
Treatments	7	89.96^{NS}	355.93^{**}	762.22^{**}	1.67^{**}	1.41^{**}	185.59^{**}	50.13^{**}	1.38^{**}	132.02^{**}	3.59^{**}	12.42^{**}	8.06^{**}
Error	14	97.66	5.21	2.73	0.09	0.03	5.24	0.12	0.05	0.50	0.10	1.53	0.31
Total	23												

^{NS} Non-significant; ** Indicates the significance at 5% level of probability

Table 3. Impact of organic and inorganic sources of nitrogen and phosphorus on growth, yield and quality of forage oat (*Avena sativa* L.)

Treatments	Germination count	Plant height (cm)	No. of tillers m^{-2}	No. of tillers /plant	No. of leaves /plant	Leaf area /plant	Fresh weight /tiller	Dry weight /tiller	Green fodder yield (t ha^{-1})	Crude protein (%)	Crude fiber (%)	Ash (%)
T_1	189.83	116.6 e	277 e	5.943 e	4.833 g	105.2 f	17.87 g	2.977 f	38.133 e	7.860 d	30.10 c	10.17 d
T_2	195.47	146.3 a	338 a	8.023 a	6.867 a	128.0 a	30.10 a	5.010 a	74.667 a	10.76 a	37.00 a	15.14 a
T_3	192.64	122.4 d	290 d	6.353 de	5.800 cd	109.8 de	24.33 d	4.053 cd	61.033 c	8.933 c	34.83 ab	11.07 d
T_4	190.70	120.2 de	294 d	6.53 cd	5.467 de	107.2 ef	23.33 e	3.887 d	63.467 c	8.900 c	34.83 ab	11.13 d
T_5	193.30	141.7 b	320 b	7.893 a	6.267 b	123.7 b	27.30 b	4.550 b	69.000 b	9.840 b	35.24 ab	13.67 b
T_6	190.23	140.0 b	317 b	7.533 ab	6.000 bc	116.6 c	26.1 c	4.360 bc	70.000 b	9.830 b	35.20 ab	13.67 b
T_7	191.86	132.0 c	308 c	7.033 bc	5.233 ef	113.5 cd	20.40 f	3.403 e	49.533 d	7.737 d	33.33 b	12.84 bc
T_8	194.69	131.4 c	306 c	6.867 cd	5.000 fg	114.7 c	20.30 f	3.383 e	51.700 d	8.010 d	33.33 b	12.50 c
LSD (*P*=0.05)	NS	3.99	2.89	0.55	0.34	4.01	0.61	0.39	0.56	0.55	2.16	0.97

Any two means sharing same letters did not differ significantly at P=0.05; T_1 = Control (no fertilizer); T_2 = N: P2O5 @ 150:60 kg ha^{-1}; T_3 = Farm yard manure @ 4000 kg ha^{-1}; T_4 = Poultry manure @ 3000 kg ha^{-1}; T_5 = N: P2O5 @ 112:45+ Poultry manure @ 750 kg ha^{-1}; T_6 = N: P2O5 @ 112:45+ Farm yard manure @ 1000 kg ha^{-1}; T_7 = N: P2O5 @ 37.5:15+ Poultry manure @ 2250 kg ha^{-1}; T_8 = N: P2O5 @ 37.5:15+ Farm yard manure @ 3000 kg ha^{-1}

$N:P_2O_5$, 37.5:15 + Poultry manure @ 2250 kg ha^{-1} and $N: P_2O_5$, 37.5:15 + Farm yard manure @ 3000 kg ha^{-1} and were also statistically at par with control treatment having 7.86% crude protein. The results are in line with the findings of Safdar (1997) who reported that in fodder maize, by increasing nitrogen levels; crude protein, crude fiber and ash contents were increased. Similarly Tariq (1998) reported that in fodder maize, by increasing nitrogen levels; crude protein, crude fiber and ash contents were increased and Ahmad (1999) also reported that crude protein percentage increased with the increase of nitrogen fertilizer. Crude fiber is another parameter influencing the quality of fodder crops. The higher is the fiber percentage in the feeding material the lower will be its quality. Data regarding the crude fiber %age in table 2; 3 exhibited that all the treatments have highly significant effect on crude fiber %age. Statistically the maximum crude fiber percentage was observed in T_2 ($N:P_2O_5$ @ 150:60 kg ha^{-1}) having 37% crude fiber followed by T_3 (Farm yard manure @ 4000 kg ha^{-1}), T_4 (Poultry manure @ 3000 kg ha^{-1}), T_5 ($N:P_2O_5$ @ 112:45 + Poultry manure @ 750 kg ha^{-1}) and T_6 ($N:P_2O_5$ @ 112:45 + Farm yard manure @ 1000 kg ha^{-1}) produced crude fiber %age of 34.83, 34.83, 35.24 and 35.2, respectively and were statistically same with each other. While statistically the minimum crude fiber 30.1% was observed in T_1 where no source of fertilizers was applied. The results are similar with the findings of Rafiq *et al.* (1996) who checked the effect of nitrogen application on growth, green fodder yield and quality of maize cv. Neelum. He observed that fiber contents (35.35%) were higher with 250 N kg $^{-1}$ than with similar application of nitrogen and Safdar (1997) reported that green fodder yield; protein, fiber and total ash contents were increased with nitrogen rates in maize. Tariq (1998) also reported that in fodder maize, by increasing nitrogen levels; crude protein, crude fiber and ash contents were increased. The total ash percentage 15.14 was observed in the treatment T_2 ($N:P_2O_5$ @ 150:60 kg ha^{-1}) which differed highly significantly with all the other treatments. The treatment T_5 ($N:P_2O_5$ @ 112:45 + Poultry manure @ 750 kg ha^{-1}) and T_6 ($N:P_2O_5$ @ 112:45 + Farm yard manure @ 1000 kg ha^{-1}) showed statistically the same total ash percentage 13.67 but were statistically at par with treatment T_7 having ash percentage of 12.84 where also the combination of inorganic and organic sources of fertilizers were used. Significantly the minimum ash percentage was recorded in the treatments T_1 (control), T_3 (Farm yard manure @ 4000 kg $ha^{-1)}$ and T_4 (Poultry manure @ 3000 kg ha^{-1}) with an ash percentage of 10.17, 11.07, and 11.13, respectively while all these treatments were also statistically at par with each other. The results are inconsonance with the findings of Safdar (1997) who reported that green fodder yield; protein, fiber and total ash contents were increased with nitrogen rates in maize and similarly Tariq (1998) reported that in fodder maize, by increasing nitrogen levels; crude protein, crude fiber and ash contents were increased.

***Conclusions*:** From the above discussion and keeping in view over all the performance, it was concluded that mineral fertilizer at recommended dose T_2 ($N:P_2O_5$ @150:60 kg ha^{-1}) was found to be the most appropriate than all other treatments studied in the experiment for exploiting the yield potential of oat (*Avena sativa* L.) cultivar oat-2000 under Faisalabad conditions.

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