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"Effect of Nitrogen on the Fodder Yield and Quality of Two Sorghum Cultivars (*Sorghum bicolor* L.)"

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DECLARATION

I hereby declare that the project work entitled **–"Effect of Nitrogen on the Fodder Yield and Quality of Two Sorghum Cultivars *(Sorghum bicolor* L.*)"*** is a project work for the award of Degree- Master of Science in Agronomy, under the guidance of **Dr. D. S. Gaikwad,** Assistant Professor, School of Agriculture, Lovely Professional University, Phagwara, Punjab (India).

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SYNOPSIS
AGR 596

"Effect of Nitrogen on the Fodder Yield and Quality of Two Sorghum Cultivars *(Sorghum bicolor L.)"*

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CERTIFICATE

This is to certified that this synopsis entitled **"Effect of Nitrogen on the Fodder Yield and Quality of Two Sorghum Cultivars (*Sorghum bicolor L.*)"** submitted in partial fulfillment of requirements for degree-Master of Science in Agronomy by **Amninder Kaur, Reg. no. 11715366** to Department of Agronomy, School of Agriculture, Lovely Professional University, has formulated and finalized by the student himself on the subject.

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INTRODUCTION

Sorghum also known as *Sorghum bicolor* (botanical name) is genus of flowering plants in the grass family Graminae. It is similar in appeareance to corn. It grows anywhere between 2-8ft tall. It has strong roots which extend up to 2.5mtrs below ground. After wheat the maximum amount of cultivated land in India is used for growing jowar. Seeds are rounded and pointed at the base, the color being brownish, yellow, pink or white. Sorghum is 5th most important cereal crop in the world after rice, wheat, maize & barley. It is native to tropical and subtropical regions of all continents in addition to south West Pacific and Australasia. It is grown worldwide for grain production, animal fodder, production of alcoholic beverages, and biofuels. The advantage of this crop is that it is cultivated in both kharif and rabi season. Sorghum is 5th most important cereal crop in the world after rice, wheat, maize & barley (Shamme *et al.* (2015). Local names of sorghum is jowar but it is called great millet/sorghum(English), juar(Bengali/Gujrati/Hindi), Jwari(Marathi), jola(Kannada), jonnalu(Telugu), Cholam(Ta mil/Malayalam), janha (Oriya). It is very nutritious just like corn and can be used as green fodder, dry fodder, hay or silage. In comparison to other cereal food items, jowar has a significant value.

In northern India, it is a suitable Kharif crop and hence sowing is done accordingly. With sufficient irrigation facilitates, the sowing is done during the month of july. In areas whre irrigation facililities are not perfect; the best time for sowing is during the period, one week before the monsoon onset. In the states of Maharashtra, Karnataka and Andhra Pradesh, jowar is planted as Rabi crop. The right time for such sowing is during the second fortnight of September till the middle of October. The summer variety of sorghum is planted within the period of January and February, mostly in areas like Andhra Pradesh and Tamil Nadu.Different sorghum cultivars vary in fodder yield as well as quality of fodder (Sarfraz *et al.*, 2012). Ayub *et al.* (1999) found higher yield of green fodder as well as dry fodder in sorghum cultivar viz. Hegari. That was due to enhanced plant height and greater stem diameter of this variety. In another study Ayub *et al.* (2010) also found that different sorghum varieties differ in their yield potential. The plant nutrition may not only affect the

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forage production but also improve the quality forage from view point of its protein contents.

Sorghum is a major crop of semi-arid tropics of Africa and Asia, and is an important component in traditional farming systems and in diets of millions of people. The crop belongs to the elite handful of plants that collectively provide more than 85% of all human energy. Wide diversity exists within the crop with different types of sorghum being grown in different parts of the world and the crop has great potential because of its diversity in use. Unfortunately, this potential promising crop has not February its full potential because of several drawbacks that have kept its production at lower levels as compared to other cereals. It has a somewhat plain neutral taste and is known to absorb flavors. It might have a slight sweet after taste.

India is second largest producer of sorghum in the world; the yield of 840kg per hectare is the lowest amongst the major sorghum-producing countries in the world. The world average is 1435kg per heactares. Although yield of sorghum in India is much lower than the world average, it has been consistently increasing during the recent past. Only 5% sorghum in India is irrigated. Over 48% of the areas under sorghum is cultivated in the country is Maharashtra and Karnataka for the grains. Rabi crop is almost entirely used for human consumption whereas Kharif crop is not very popular for human consumption and is largely used for animal feed, starch, and alcohol industry. The production of sorghum in India is 8.71 million tonnes. The production amounts to about 4.6 lakh tonnes. Maharashtra stands first in area (5.14m ha), production (3.91m tonnes) and productivity (761 kg/ha) followed by Karnataka.

Overuse of nitrogen fertilization can cause environmental pollution by leaching or gas emissions (Yolcu *et al.* 2011). Fertilizer also has a significant share in the cost of production; therefore, optimizing of nitrogen fertilizer as much as possible is imperative for profitability, productivity and sustainability as well in plant production. Optimal nitrogen rate can be different depended on ecological conditions, irrigation and rainfall distribution. Ram and Singh (2001) reported that growth and yield responses sorghum sudan grass to nitrogen rates was only up to 80 kg/ha, however, Ikanovic *et al.*, (2010) reported that optimal N rate for sorghum was 180 kg/ha

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OBJECTIVES

Keeping in view all these aspects the present study in Sorghum is undertaken with following objectives:

1. To study the effect of Nitrogen application on growth and yield of fodder Sorghum.
2. To study the morphology of the crop under different applications of nitrogen
3. To study about proximate composition of sorghum

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REVIEW OF LITERATURE

Yagoub S.O. and Abdelsalam A.K. (2010) showed that significant differences for second cutting and third cutting of first and second seasons respectively for plant height and leaves area index.. The number of leaves showed significant differences in the second cutting in the first season only. The results also indicated that there were significant differences for plant population, dry weight for two season but for fresh weight the significant difference was appeared only in the first season only , and also the variation is due to nitrogen nor seed rate.

Afzal M., Ahmad A. and Ahmad AU. H. (2012) concluded that increasing nitrogen dose increased all growth attributes. Results revealed for first, second and third cuttings showed significant differences at all growth attributes. Thus, the maximum plant height was observed in N4 (100 kg N/acre), having plant height 193.92, 195.24 and 192.79 cm in first, second and third cutting, respectively, which was followed by the treatment N3 (75 kg N/acre), having 179.70cm in first cutting, while second and third cutting have same plant height 168.62 cm. The exception was the plant population showed non -significant behavior in second and third cutting while number of leaves per plant in second cutting only and protein % in third cutting showed non-significant difference with nitrogen application.

Saini Amandeep (2012) concluded that quality of sorghum was significantly improved with the application of nitrogen up to 125 % of the recommended doses. The study revealed that significantly higher dry matter, crude protein, crude fat, mineral matter and NFE productions were obtained with the harvesting ofcropat100days after sowing.

Afzal *et al*., (2013) perceived that the growth, yield and quality parameters differed significantly among the different nitrogen levels and sowing methods. The observations including plant height, number of leaves per plant, stem diameter, leaf area per plant, fresh weight per plant, dry weight per plant, total green forage yield, total dry matter yield, crude protein and ash % in three cuttings showed that drill sowing at 30 cm 01apart rows with nitrogen level of 57.5 kg ha-1 enhanced significantly the growth and yield of sorghum compared to the other treatments under the environmental conditions of Faisalabad.

Roy D.C.and Tudu N.K. (2013) concluded that effect of phosphorus on total ash (TA) content was found not significant in all the three cuts. Ether extract (EE) and Nitrogen free extract (NFE) were increased significantly with the application of phosphorus in all the three cuts. Based on the above findings it can be concluded that application of phosphorus at the rate 120 kg ha-1 significantly increase the green fodder yield as well as the nutritional values of sorghum.

Ahmad *et al..*, (2014) concluded that Sorghum cultivars differed in forage yield, dry matter yield, morphological traits and quality parameters. Maximum plant height, stem diameter, leaf weight per plant, leaf area per plant, fresh weight per plant, dry weight per plant, forage yield, dry matter yield and ash percentage were recorded in Pak-China-1 followed by F-114. Plant height, number of leaves per plant and plant population per unit area was minimum in Sandal-Bar. Crude protein and crude fiber were more in Sandal bar and F-7017 respectively as compared to other varieties.

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Ikanović *et al.*, (2014) discerned that there have been significant fluctuations in production indicators between the genotypes. In the total average, the lowest yield was recorded for the Sudan grass (85.41 t ha-1). Significantly higher yields were recorded for the interspecies hybrid (90.22 t ha-1) and the forage sorghum (93.51 t ha-1). Although the effect of nitrogen rates depended on weather conditions, i.e. rainfall distribution, the optimal nitrogen rate in both years was 180 kg ha-1.

Haq Hazary *et al.*, (2015) perceived that a significant effect (P<0.01) was found on green biomass yield at 80 (N2) and in case of P application for green biomass yield, statistically non-significant (P>0.05). Application of N fertilizer had a significant (P<0.01) effect on DM yield at the dose N1 (40 kg/ha). DM content (g/100 g DM) decreased significantly (P<0.01) with increasing level of N fertilizer. P fertilizer had no significant effect on DM content. CP content increased significantly (P<0.01) with the increasing level of N fertilizer up to 80 kg N/ha and linearly decreased with increasing level of P fertilizer.

Sher *et al*., (2016) discerned that Increasing N rates (0 to 120 kg ha-1) raised all above mention bio-chemical attributes but not NFE. Similarly, increased seed rate enhanced accumulation of CP, CF, EE, TA, CPY and CFY while caused reduction of OM and NFE. Genotypic variations may have influenced the accumulations of these traits however, differences were not significant. In conclusion, sorghum cultivar JS-2002 seeded at 75 kg ha-1 with 120 kg N ha-1 application produced better quality forage under subtropical conditions .

Nirmal *et al*. (2016) observed that the application of 125 % N level of RDF ha-1 significantly increased the growth attributes viz., plant height, number of leaves plant-1, dry matter plant-1, number of internodes plant-1 at harvest as compared to rest of the nitrogen levels and it was remained at par with the application of 100 % N of RDF ha-1.

Mekdad and El-Sherif (2016) observed that that the effect of nitrogen levels as well as, potassium levels had a highly significant positive effect on yield, yield components and quality traits, varieties differed significantly in stem diameter, seed index and theoretical ethanol yield in both seasons, the highest former traits produced by Brandes variety (V2). The highest values of seed index in both seasons, as well as brix, juice extraction, juice yield and sugar yield in the first season, while stem length, leaf weight and leaves yield in the second season were obtained by Brandes (V2) variety with 120 kg N/fed (N3) with 75 (K3) kg K\fed. The highest yields of sugar and juice were 1.83 and 10.68 t/fed were obtained from the trilateral interaction among Brandes (V2) variety with 120 kg N/fed (N3) with 75 (K3) kg K\fed in the first season, respectively.

Shivprasad Mane and Singh Rajesh (2017) revealed that treatment combinations of spacing of 30cm×10cm with 120 kg nitrogen ha-1(T8) recorded maximum higher plant height, number of leaves, dry weight, green fodder yield, leaf: stem ratio, fodder quality net return and benefit cost ratio followed by that recorded treatment spacing of 30cm×10cm with 100 kg nitrogen ha-1(T7).

Molaaldoila *et al*. (2017) perceived that maximum yield and forage of sorghum and bean were obtain by nitrogen application nitrogen level N138 under monoculture cropping and N92 under intercropping but further application had no effect on yield and forage. At these nitrogen levels intercropping provided many benefits through increased efficiency of nitrogen uptake (NU). The results also clearly showed that

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intercropped yield of sorghum Yab associated strongly with CR while yield of bean Yba was associated strongly with land equivalent ratio (LER) and Advantage of intercropping (AI). Moreover, economic evaluation indices RVT, AYL, RYT and MAI, can be used as good indicators of the economic feasibility of intercropping system. On the other hand, the results also indicated that (SV2) were more responsive to high yielding environmental change than (SV1), while intercropped common bean (Taiz-305) with (SV1) was more responsive and stable under wide range of environments (locations and years).

Habib *et al*., (2017) discerned that N levels significantly affected (P<0.05) FM and DM of millet but did not influence yield of sorghum and sudan grass. Millet was highest (P<0.05) in production than any other species. However, sorghum and sudan grass did not differ from each other. RWC of all the three species did not show any statistical difference. PH of millet was maximum (P<0.05) than sorghum and sudan grass. LN mimicked sequence already explained for PH. LSR decreased for millet with increasing N supply. CGR during the linear growth phase decreased significantly for millets under low N. Among the fodder quality parameters, all observation found non-significant for the species irrespective of the N levels. However, millets showed higher (P<0.05) ash content, CP, IVDMD and ME to sorghum and sudan grass.

Abo-Zeid S.T. , Abd EL-Latif Amal L. and Elshafey S. (2017) observed that the fresh and dry forage yield ton/fed, nitrogen, crude protein, phosphorus, potassium, nitrite (NO2) and nitrate (NO3)contents were significantly decreased in the second cutting as compared with the first one over both seasons. Using ammonium sulphate "(NH4)2 SO4" was better than using ammonium nitrate "NH4 NO3" as a source of nitrogen fertilizer over both cuttings and seasons. Fresh and dry forage yields of sudangrass were significantly increased as nitrogen rates increased from 50 to 75 and 100 kg N/fed and significantly decreased due to increasing nitrogen rate from 100 to 125 kg N/ fed over both seasons.It can be recommended that mineral fertilizing of sudangrass plants with 75100- kg N/fed is better to get suitable forage yields and reduce nitrate accumulation in plant.

Somashekar *et al*., (2018) concluded that Among nitrogen levels, application of 30 kg/ha recorded significantly higher green fodder (69.60 t/ha), dry matter yield (15.91 t/ha) and growth parameters like plant height (148.37 cm), number of tillers per meter row length (69.97), leaf stem ratio (0.23), crude protein yield (1.26 t/ha), crude fiber yield (5.34 t/ha), nitrate nitrogen content (1168.06 ppm), net returns (Rs. 31285/ha) and B: C ratio (2.20).

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MATERIAL AND METHODS

Location of experiment: The experiment is conducting at the main Experiment Station, Department of Agriculture, Lovely Professional University, Phagwara, Punjab, located at latitude of 31.2498190 and longitude of 75.7084550 as map coordinates along with altitude of 232 m above sea level.

Climate: In Punjab generally temperature ranges 18-25 degree C from December – Feb. Which is suitable for growing Sorghum.

Soil: The soil status of experimental site is sandy loam soil, well fertile and free from weeds and well tilth soil. Has good drainage and rich in nutrients. The soil experimental field was sandy loam in texture, acidic in reaction with low level of organic carbon, available nitrogen and available P2O5 but a medium level of available K2O.

Year and Session of Experiment: January2018, session -2018-19.

Varieties: Two

1. Jumbo Gold
2. Rasila

Experimental design: Random block design (RBD)

Proximate analysis : AoAC (1984)

Number of replication: 4

Size of plot: 500 m^2

Size of each plot: 5*2 m^2

Number of varieties hybrids: 2

Number of plots: 32

Number of treatments: 08

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TREATMENT DETAILS

Treatments	Details
T_1	No dose of fertilizer (Control) (variety 1)
T_2	Recommended dose of fertilizer (Variety 1, 100% dose of RDN)
T_3	75% dose of fertilizer (variety , 75% dose of RDN)
T_4	50% dose of fertilizer (variety , 50 % dose of RDN)
T_5	No dose of fertilizer (Control) (variety 2)
T_6	Recommended dose of fertilizer (variety 2, 100% dose of RDN)
T_7	75% dose of fertilizer(variety 2, 75% dose of RDN)
T_8	50% dose of fertilizer(variety 2, 50% dose of RDN)

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FIELD LAYOUT

R1		R2	R3		R4
T1		T3	T4		T8
T2		T4	T3		T7
T3		T7	T2		T6
T4	C H A N N E L	T8	T1	C H A N N E L	T5
T5		T6	T8		T1
T6		T5	T7		T2
T7		T2	T6		T3
T8		T1	T5		T4

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5. OBSERVATIONS TO BE RECORDED

Data will be recorded on the following parameters :

Morphological parameters:

(Randomly from 5 plot)

1. Plant height (cm) up to 30days, 50 days, and 70days
2. Stem girth (cm) up to 30days, 50 days, and 70days
3. Number of leaves up to 30 days , 50 days and 70 day.
4. Stem weight and leaf weight per plant.
5. HCN Content.
6. Yield (kg/ha)

Soil parameters: (before sowing and at harvest)

1. PH
2. NPK content
3. Organic carbon
4. Electrical conductivity (EC)

Proximate Composition:

1. Dry matter (%)
2. Crude Fiber (%)
3. Ether Extract (%)
4. Crude Protein (%)
5. Nitrogen Free Extract (%)
6. Ash (%)

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