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Performance of Different Rhodes Grass Varieties under the Agro-Climatic Conditions of Sindh, Pakistan

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Abstract- Seed variety is the most important input that contributes to the yield, growth and to the quality improvement of the annual forage plants. By keeping this fact in view an experiment was conducted in the Siddique Farm, Tando Adam, Sindh to determine the best suited cultivar for Rhodes grass in its climatic zone. The experiment was laid out in a randomized complete block design (RCBD) with three replications. The economic and qualitative parameters studied during the research study was plant height, tillers / plant, leaves / tillers, leaf area, green fodder yield, dry matter yields, crude protein, ether extract, crude fibre, nitrogen free extract, and ash contents respectively. Analysis of Variance showed that commercial cultivars were significantly varied from each other for dry fodder yield and other recorded characters. The cultivar Finecut produced highest (6.75 ton/ha/cut) dry fodder yield per hectare per cut. The maximum plant height (131.98 cm), tillers / plant (5.12), leaves / tillers (10.66), leaf area (323.21 cm^2), green fodder yield (23.53 ton/ha/cut), and crude protein content (9.23) was also observed for the cultivar Finecut. However, the other Rhodes grass varieties showed less yielding results for all the agronomic parameters. Statistical analyses of all the research parameters are elaborated in Table 01 and Table 02 respectively. From the obtained statistical results it can be concluded that the cultivar Finecut has a best genetic potential to perform better and hence it is recommended that these cultivars are best suited to cultivate in the arid region of Tando Adam, Sindh – Pakistan.
Keywords: Rhodes Grass, Nitrogen Fertilizer, Finecut, Irrigation, Agriculture, Crude protein, Sindh, Pakistan.

I. INTRODUCTION

Rhodes grass (Chloris Gayana. L. Kunth.) is a summer-growing, stoloniferous perennial grass. It is an important multicut and multi-tillering annual fodder. Rhodes grass is adapted to a wide range of soils, from infertile sands to fertile clays. In Pakistan, fodder production is very important because the fodder is a basic source of energy utilized for feeding the livestock. It can successfully provide the fodder for animal during the lean period. According to the past studies it can be noted that Rhodes grass is cultivated on more than 1 lac acres of Sindh, Punjab and some areas of Balochistan, which is utilized for fodder production (Arshad et al., 2014)[1]. Rhodes grass in hay form is very much popular around the globe especially in gulf regions i.e. UAE, Qatar, Oman and KSA. Rhodes grass has high protein value (9 – 12%) and the average water consumption for its production is about 600 mm to 1200 mm. Rhodes grass sowing can be done from March to April and August to September in arid regions of the country where summer comes early. One time sowing of Rhodes grass will give the production to the growers for about 3-4 years (Arshad, 2012) [2].

There are five main types of Rhodes grass varieties i.e. Pioneer, Katambora, Finecut, Callide, and Topcut but among all Finecut is most popular variety. Finecut is popular because of its productive yield. Seed variety is the most important input that contributes to the yield, growth and to the quality improvement of the annual fodder plants. It has been observed from past studies that Rhodes grass Finecut and Katambora responded well to nitrogen fertilizer after a basic pre-plant phosphorous application (Rahman et al., 2007) [3]. Production of Finecut was remarkable when Nitrogen fertilization was applied in a separate split dose (Valenzuela et al., 2002) [4]. However, the excessive use of fertilizers with irrigation water in the field of Rhodes grass can reduce the quality and production parameters. Over irrigation should to be controlled during the initial growth stage or the safe keeping of grass.

Considering the above facts in view, the present investigation was conducted at Siddique Farms Tando Adam, Sindh – Pakistan. The primary focus of this research was to find out the best performance of a cultivar, a test for its adoptability and various growth characteristics is imperative. Selection based on yield components may help to identify and develop lines having improved and more stable yield (Qamar et al., 2000) [5]. The main objective of the study was to determine the best commercial Rhodes grass cultivar which produce highest grass yield under the climatic conditions of Mirpur Khas Sindh, Pakistan.

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II. MATERIALS AND METHODS

The comparative study to find out the best performance of a cultivar pertaining to Rhodes grass yield and growth was conducted in February (2013 / 2014) in Siddique Farms Tando Adam, Sindh – Pakistan. Five commercial Rhodes grass cultivars source from Australia i.e. Pioneer, Katambora, Finecut, Callide, and Topcut was used for assessing the yield potential and other parameters in the agro climatic conditions of Tando Adam. The experiment was laid out in a randomized complete block design (RCBD) with three replications. In preliminary step the weeds and extra grass were cleared by using two split crosswise cultivator operations supplemented with disk plow in order to ensure uniform distribution of irrigation water. The land was then rough leveled by tractor with front and rear blade. In order to break the big mud stones (particles) of soil in to small fine particles the wooden deck and rotavator was used to ensure effective germination. After leveling pre- irrigation of 1 inch / acre of irrigation water was supplied in order to observe re-growth of grass and weeds. Then after 4-5 days the grown weeds and grass were cleared by using cultivator and tooth harrow operation accordingly. Finally, with the help of border maker the prepared land was divided in to small sub-plots to carry out the pilot study.

The Rhodes grass seeds of five different cultivars were sown at the rate of 10 kg/ acre in the prepared land and Phosphorous fertilizer dose applied at sowing accordingly. Nitrogen was applied in split doses by broadcasting. Total eight cuts were obtained during the study period. The first and second cut was harvest after 2.25 and 2 months respectively. The remaining 6 cuts were obtained on monthly basis. The data on different quantitative and qualitative traits were recorded using ten randomly selected competitive plants from each replication at 50% flowering stage. The characters under studies was plant height, tillers / plant, leaves / tillers, leaf area, green fodder yield, dry matter yields, crude protein, ether extract, crude fibre, nitrogen free extract, and ash contents respectively. For quality tests the dried samples of all the plots were chopped separately into small pieces and send to Qualitest Laboratory, North Nazimabad, Karachi - Pakistan; where proximate composition was conducted. Finally, data analysis and statistical analysis were done through ANOVA procedure. Figure 1(a) – 1(h) describes the overall harvesting / bailing operations which were studied during this pilot study.

Fig: 1(a) Rhodes Grass at 50% Flowering

Fig: 1(b) Cutting operation with Mover Machine

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Fig: 1(c) Racking Operation with Racker Machine

Fig: 1(d) Bales preparation with Big Bailer Machine

Fig: 1(e) Ready Bales for Transportation

Fig: 1(f) Transportation of Ready Bales from Field to Open Field Temporary Storage

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Fig: 1(g) Arranging Bales for Temporary Open Field Storage

Fig: 1(h) Transportation of Stored Bales from Open Field Temporary Storage for Shipment

III.RESULTS AND DISCUSSION

The subject research was carried out to check the performance of Rhodes grass yield and growth rate for five different cultivars. The outcome of the study revealed that Rhodes grass plant height, tillers / plant, leaves / tillers, leaf area, green fodder yield and dry matter yields, crude protein, ether extract, crude fibre, nitrogen free extract, and ash contents differed very significantly at ($P \leq 0.05$) as shown in Table: 01 and Table: 02 respectively. The critical gathered observations and data for the above discussed parameters during the research study are appended below:

A. *Economic Characters Studied for Rhodes Grass*

1) *Plant Height:* The response of the cultivars to the plant height was found highly significant (Table: 01). The lowest plant height was observed in Topcut (114.29 cm) followed by the Callide (115.82 cm). However, the highest plant height was attained by Finecut (131.98 cm) followed by the Katambora (123.03 cm) respectively. Similar results were obtained for plant height for Rhodes grass by (Yousif et al., 2012) [6], who also observed the variation in Rhodes grass cultivars for the plant height.
2) *Tillers / Plant:* Different cultivars response to the tillers/plant was observed highly significant (Table: 01). The lowest tillers/plant was observed in Callide (4.23) followed by the Katambora (4.39). However, the highest tillers/plant was attained by Finecut (5.12) followed by the Pioneer (4.98) respectively. These results were according to the observation of (Ali et al., 2001) [7], who also observed the variation in Rhodes grass cultivars for the tillers/ plant.
3) *Leaves / Tiller:* The analysis of variance (Table: 01) indicated that all cultivars were highly significant ($P < 0.05$) for the leaves / tiller. Once again the highest leaves /tiller was attained by Finecut (10.66) followed by the Pioneer (9.65) respectively. However, the lowest leaves / tillers was observed in Callide (9.11) followed by the Topcut (9.30) respectively. The statistical analysis showed that these cultivars were statistically same for this trait. These results were totally according to the observations of the (Saad, 2010) [8].
4) *Leaf Area:* The analysis of variance (Table: 01) indicated that all cultivars were highly significant ($P < 0.05$) for the trait leaf area. It has been observed that cultivar Finecut showed highest leaf area (323.21 cm^2) followed by Katambora (298.52 cm^2) and lowest leaf area was observed for Topcut (280.37 cm^2) followed by Callide (287.62 cm^2) respectively. The statistical analysis showed that these cultivars were statistically at par form each other for this trait. These results were totally according to the observations of the (Mirza et al., 2002) [9].
5) *Green Fodder Yield:* All cultivars showed the highly significant ($P < 0.05$) differences for the green fodder yield per hectare

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per cut (Table: 01). The maximum yield for green fodder per hectare was observed for the cultivar Finecut (23.53 ton/ha/cut) followed by Katambora (20.91 ton/ha/cut), while the lowest yield per hectare was observed for the Topcut (17.67 ton/ha/cut) and Callide (20.02 ton/ha/cut) respectively. Similar results were obtained for green fodder yield for Rhodes grass (Borhan et al., 2000) [10].

6) *Dry Fodder Yield:* Different cultivars response to the dry fodder yield was observed highly significant (Table: 01). The lowest dry fodder yield per hectare observed in Topcut (4.38 ton/ha/cut) followed by the Pioneer (50.12 ton/ha/cut). However, the highest dry fodder yield per hectare was attained by Finecut (6.75 ton/ha/cut) followed by the Katambora (5.62 ton/ha/cut) respectively. These results were according to the observation of (Brima, 2011) [11], who also observed the variation in Rhodes grass cultivars for the dry fodder yield.

Table: 01. Effect of different levels of NP application on quantitative parameters of Rhodes Grass.

Rhodes Grass Cultivars	Plant Height (cm)	Tillers / Plant	Leaves / Tiller	Leaf Area (cm^2)	Avg. Green Fodder Yield (t/ha/cut)	Avg. Dry Fodder Yield (t/ha/cut)
Pioneer	119.94bc	4.98bc	9.65b	293.06b	20.14bc	5.12bc
Katambora	123.03b	4.39ab	9.31b	298.52b	20.91b	5.62b
Finecut	131.98a	5.12a	10.66a	323.21a	23.53a	6.75a
Callide	115.82bcd	4.23b	9.11b	287.62b	20.02b	5.56bc
Topcut	114.29cd	4.52bc	9.30b	280.37b	17.67bc	4.38cd

Means followed by different letter shows significant result at 5% level of significance.

B. *Qualitative Parameters Studied for Rhodes Grass*

In order to determine the quality and nutritive value of different qualitative parameters of Rhodes grass the dried samples of all the plots were chopped separately into small pieces and send to Qualitest Laboratory, North Nazimabad, Karachi, Pakistan. The qualitative parameters studied were crude protein, ether extract, crude fibre, nitrogen free extract, and ash contents respectively. The data revealed that the highest crude protein contents of (9.23%) were recorded for the cultivar Finecut followed by Pioneer (8.46%), while the lowest crude protein content was found in Topcut (6.50%) respectively. Similar results were obtained for crude protein content for Rhodes grass by (Arshad et al., 2014) [1] and (Yousif et al., 2013) [6]. The detailed qualitative comparisons of nutrients value in all eight cuts for different parameters are appended below in Table 02.

Table 02. Effect of different levels of NP application on qualitative parameters of Rhodes Grass.

Rhodes Grass Cultivars	Crude Protein (%)	Crude Fibre (%)	Ash (%)	Nitrogen Free Extract (%)	Ether Extract (%)
Pioneer	8.46b	29.70a	8.37a	50.52ab	1.29a
Katambora	9.19a	29.29a	7.19a	47.45b	1.95a
Finecut	9.23a	29.30a	8.31a	50.56a	1.32a
Callide	7.51c	28.19a	8.14a	52.35a	1.46a
Topcut	6.59c	31.51a	8.59a	49.29ab	1.22a

Means followed by different letter shows significant result at 5% level of significance.

IV. CONCLUSIONS

As a consequence of subject study it can be concluded that different Rhodes grass cultivars had a significant effect on growth and the higher yield of Rhodes grass. The experiment was laid out in a randomized complete block design (RCBD) with three replications. The economic and qualitative parameters studied during the research study was plant height, tillers / plant, leaves / tillers, leaf area, green fodder yield, dry matter yields, crude protein, ether extract, crude fibre, nitrogen free extract, and ash contents respectively. Analysis of Variance showed that commercial cultivars were significantly varied from each other for dry

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fodder yield and other recorded characters. The cultivar Finecut produced highest (6.75 ton/ha/cut) dry fodder yield per hectare per cut. The maximum plant height (131.98 cm), tillers / plant (5.12), leaves / tillers (10.66), leaf area (323.21 cm^2), green fodder yield (23.53 ton/ha/cut), and crude protein content (9.23) was also observed for the cultivar Finecut. However, the other Rhodes grass varieties showed less yielding results for all the agronomic parameters. Statistical analyses of all the research parameters are elaborated in Table 01 and Table 02 respectively. From the obtained statistical results it can be concluded that the cultivar Finecut has a best genetic potential to perform better and hence it is recommended that these cultivars are best suited to cultivate in the arid region of Tando Adam, Sindh – Pakistan. However, further investigation is necessary to establish the present findings in other regions of Pakistan with Rhodes grass.

V. SUGGESTIONS

It is suggested to all the Rhodes grass growers that the excessive use of irrigation water in the field of Rhodes grass should to be controlled during the initial growth stage. Once the grass fully droned it will ultimately reduce the quality and production parameters. The prepared land should be free of foreign matter i.e. (big stones, previous crop remains and sharp wooden pieces) for the safe keeping of packaging machinery. As Rhodes Grass is an export cash crop therefore, it is suggested that it must be grown under the supervision of qualified consultants (agriculturists) in order to ensure excellent crop yield. Rhodes grass having crude protein content (9 – 12%) will give more profit to the growers, which ultimately may entail in earning handsome foreign exchange by its export.

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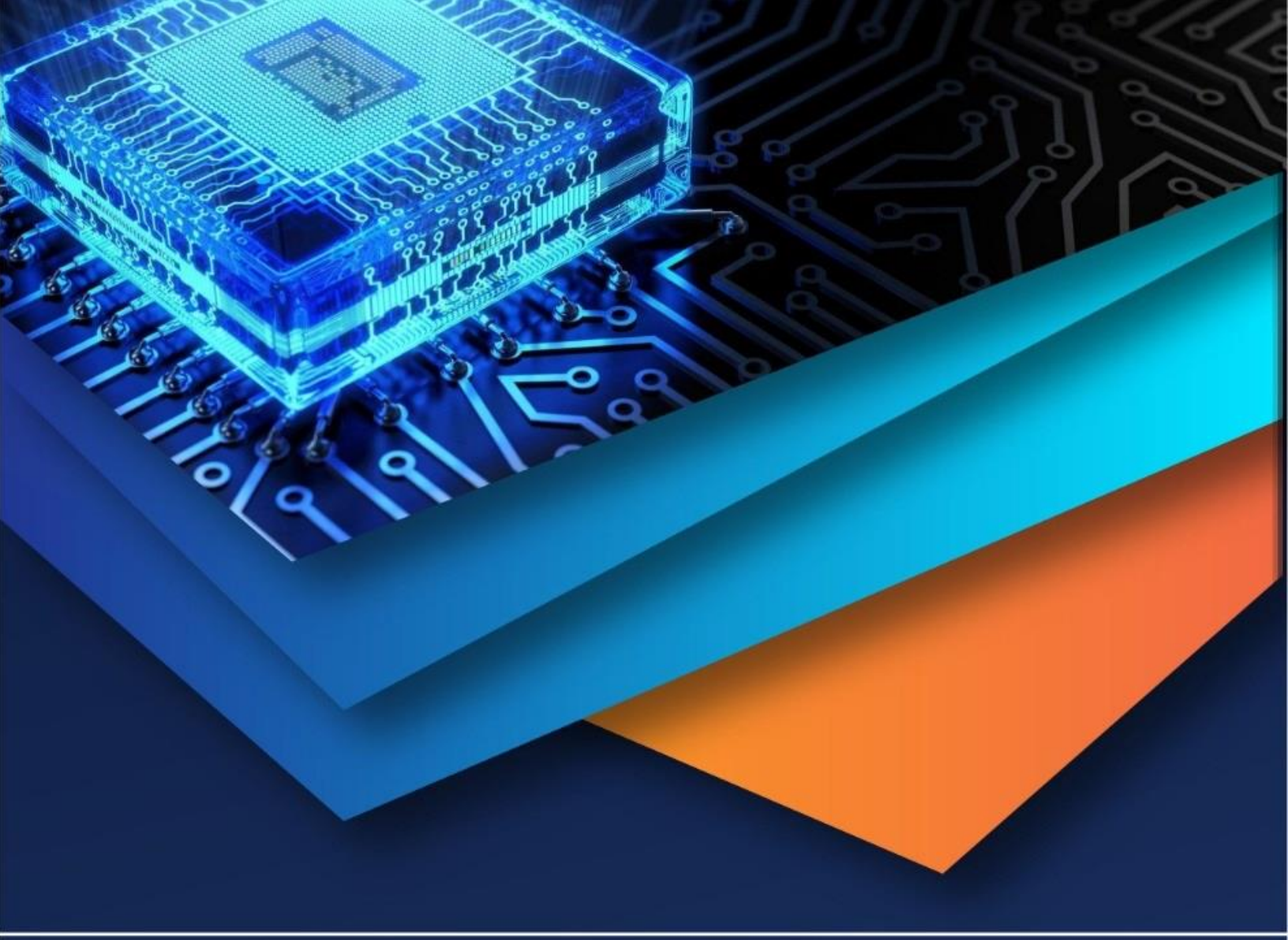

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