

# Studies on establishment and evaluation of some perennial forage mixtures

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Studies on establishment and evaluation of some perennial forage mixtures Two experiments were conducted under sprinkler irrigation in a newly reclaimed sandy soil of Ismailia at the Agricultural Experimental Station of the Agricultural Research Center. First study: The effect of seeding rates and cutting intervals on the behavior of two varieties of Rhodesgrass in respect of forage yield and quality. Two Rhodesgrass cultivars were used in this study, which were Pioneer and Katambora, the first cv. was introduced from Australia and the second one was imported from South Africa. Each of these cultivars was sown in three seeding rates of 10, 15 and 20 kg/fed. Proposed cutting intervals of Rhodesgrass forage for the two cultivars were 20, 30, and 40 days. Results could be summarized as follows:

1. Yearly and total fresh forage production of Rhodesgrass cultivars as affected by seeding rates and cutting intervals:
4. Fresh forage yield of Pioneer Rhodesgrass cultivar was higher than cv. Katambora. Such increase in fresh yield was 8.13, 2.74 and 12.22 ton/fed in the second, third year and the total yield, respectively. Also, the relevant cumulated cuts of the stand life present slight better productivity of fresh forage yield for cv. Pioneer rather than cv. Katambora
- No significant effect was noticed for the applied seeding rates of fresh yield on Rhodesgrass during the first and the third year as well as the total yield.
- During the second growing year (26 cuts), slight significant and continuous decrease in fresh yield of Rhodesgrass was obtained as seeding rates increased from 1 to 15 and 20 kg/fed.
- As the cutting duration intervals of Rhodesgrass increased from 20 to 30 to 40 days, the decrease in fresh yield was continuous and significant with a respective yield of 56.53, 46.09 and 34.10 ton fed in the first year; being 161.04, 104.62 and 84.94 in the second year; and 113.30, 94.55 and 68.51 in the third year; corresponding to 329.0, 245.08 and 187.57 ton/fed for the total yield.
- Significant interaction effect of Rhodesgrass cultivars x cutting intervals noticed on the obtained fresh fodder yield.
- The effect of increasing or extending the duration period of cutting in reducing fresh yield of Rhodesgrass was much higher for cv. Pioneer as compared with cv. Katambora.
- Rhodesgrass Pioneer cv. produced the highest fresh yield at the shortest cutting interval (20 days) at any seeding rate. whereas relatively lower fresh yield was obtained for cv. Katambora at the longest cutting duration using (40 days) any of the applied seeding rates.
2. Seasonal - total fresh forage production of Rhodesgrass cultivars as affected by seeding rates and cutting intervals:
- Applied seeding rates were of insignificant effect on fresh yield during the growing seasons of stand life.
- Rhodesgrass cultivars exhibited significant effect on total fresh yields for autumn (119.32 ton/fed/31 cuts), spring (28.41 ton/fed/6 cuts) and summer (97.97 ton/fed/20 cuts) seasons.
4. • Result clarifies the relative superiority of Pioneer cv. as compared to Katambora cv. in summer followed by autumn, then spring followed by winter season with significant differences.
- The applied seeding rates did not significantly affect the obtained total fresh yield of Rhodesgrass during each of the four various seasons of the stand duration.
- general significant decrease in fresh yield of Rhodesgrass was recorded in autumn, spring and summer seasons as the cutting intervals increased. Such effect was not significant in winter season where Rhodesgrass was in a dormant situation.
- Higher Rhodesgrass productivity in fresh yield as a result of increasing the cutting intervals was noticed during autumn followed by summer then spring season.
- Pioneer cv. was higher in fresh yield than cv. Katambora, whereas its decrease in production was more than cv. Katambora as the cutting intervals increased.

desgrassing intervals: during the first led to be 30.04 ),

and slightly d year (22 cuts) fed/59 cuts. forage yield as growing years year and total cv. Katambora igher than cv. antly affect the ars or the total dry yield was to the appliedto 30 and up to duction in dry growing years20 to 40 days ith about 55%, and total yield,3. Yearly and total dry forage production of Rhcultivars as affected by seeding rates and cuvDry Rhodesgrass yield was 16.71 tonfed. established year (11 cuts), then almost dou ton/fed. during the second year (26 cut decreased to be 19.74 ton fed. during the thi with a total dry yield production of 66.55 tovKatambora cv. was of slightly higher in d compared with cv. Pioneer during the thre with significant difference only in the secon yield as well. Total dry yield production o (68.03 ton/fed/59 .cuts.) was 3 ton/fed. Pioneer (65.09 ton/fed/59cuts).vSeeding rates of Rhodesgrass did not signifi obtained dry yield in any of the 3 grown y yield as well. This is because the obtaine fluctuated with no specific trend accordin seeding rates.vExtending cutting duration intervals from 20 40 days caused significantly continuous r yield of Rhodesgrass in the second and thir and the total yield as well. • The increase in cutting duration interval fro caused a decrease in Rhodesgrass dry yield 46% and 48% for the second year, third year respectively.vInteraction effect of cultivars x cutting intervals on Rhodesgrass dry yield was significant in the second year, third year and total yield as well. •Reduction in dry yield of cv. Katambora was almost doubledas compared with cv. Pioneer when cutting intervals increased from 20 to 40 days with significant interaction effect. •Generally, that relatively higher dry yield was obtainedwhen growing cv. Pioneer at the shortest duration period (20 days) using any of the applied seeding rates as previously reported with fresh yield.vHighest total dry yield of Rhodesgrass cultivars was recorded at the shortest cutting duration (20 days).vReduction in dry yield of cv. Katambora was almost doubled as compared with cv. Pioneer when cutting intervals increased from 20 to 40 days with significant interaction effect. •Results evedentiated the relatively higher ability for Pioneercv. for adjusting and compensating its growth according to the plant population density situation as compared with Katambora cv.vRelatively higher dry yield was obtained when growing cv. Pioneer at the shortest duration period (20 days) using any of the applied seeding rates where the interaction was significant.4. Seasonal - total dry forage production of Rhod sgrass cultivars as affected by seeding rates and cutti i g intervals:v Total dry yield production of Rhodesgrass (6 .50 ton/fed out of 59 cuts) was distributed among the yearly seasons in the following descending order: autumn (34.88 t e n/fed out of 31 cuts) followed by summer season (24.67 t /fed/20 cuts), then spring season 5.42 ton/fed/6 cuts), foil e wed by winter season (2.75 ton/fed/2 cuts). •The highest dry yield productivity of cv. ioneer (65.Q9ton/fed) was higher than cv. Katambora (68.11 ton/fed) was noticed with significant difference.v Also noticed increased in the dry yield in autu n season, but not for the other seasons where cultivars did of exhibit any significant differences during the other grow ng seasons of the stand duration. •Extending cutting intervals (20, 30 and 40 reduced dry matter yield more sever in cv. cv. Pioneer especially in autumn and winter the interaction between such factors was signiays) generally atambora than easons where want. •Interaction of cultivars x seeding rates x cutti g intervals on the seasonal and total dry yield production w significant inall seasons and total dry yield as well. •Higher dry yield of cv. Pioneer was recorded hen cut at theshortest duration interval (20 days) using any of the applied seeding rates.5. Plant Height:Tallest grasses were noticed for autumn season, whereas the height of plants was almost similar for spring and summer seasons.vThe heights of the two Rhodesgrass cultivars were significantly different in summer season where cv. Pioneer was taller than cv. Katambora. whereas, height of plants of the two cultivars were not significantly varied in autumn and spring seasons.+It is generally noticed that tallest plants of Rhodesgrass cultivars were obtained when using the highest seeding rate (20kg/fed).vBy extending the cutting interval from 20 to 40 days, where cv. pioneer was significantly taller than cv. Katambora in spring season, while an opposite situation was noticed in summer season where cv. Katambora was taller than cv. Pioneer. However, these two cultivars were in almost similar behavior regarding plant heights during autumn season as affected by increasing the cutting intervals.+Tallest Rhodesgrass plants were obtained at the highest population densities of the highest seeding rate using the longest cutting duration.6. Chemical Analysis and Total Digestible Nutrients:As cutting intervals increased from 20 to 30 and up to 40 days, crude protein (CP) of Rhodesgrass decreasedSUMMARY 113gradually. The respective CP content was 6.43, 5.71 and 5.03 %.The CP content of Rhodesgrass was not grown cultivars as it

was affected by cutting v Pioneer c.v. was slightly higher in crude fi than Katambora c.v. and the longest cutting of 40 days produced plants of higher compared with the other two cutting into days). Increasing seeding rates of Rhodesgrass from up to 20 kg /fed caused continuous increase which was 36.24, 36.72 and 37.00%, respectively. Increasing cutting intervals of Rhod noticeable increase in its CF content which and 37.25 % at the cutting duration of 20, respectively. v Katambora cv. had almost similar ether extr as cv. Pioneer which was 2.17 and 2.05 ° Also, the medium cutting interval (30 day rates (15 kg/fed) produced Rhodesgrass of th 2.21 and 2.02 %, for Katambora and respectively affected by the intervals. er (CF) content uration interval CF content as als (20 and 30 10 to 15 and in CF contents ely. grass caused as 34.23, 36.07 0 and 40 days, t (EE) content , respectively. ) and seeding highest EE of Pioneer cvs, v Increasing cutting duration intervals of Rho • esgrass caused a clear continuous decrease in its ash content. Cutting intervals of 20, 30 and 40 days roduced Rhodesgrass of 8.04, 7.42 and 6.72 % ash content, respectively. v Katambora cv. was just 1 % higher in Nitrogen Free Extract (NFE) content compared to cv. Pioneer. Also, the longest cutting duration interval of 40 days produced slightly lighter NFE (48.96 %) content of Rhodesgrass as compared with the other shorter intervals of 20 and 30 days. • The lowest seeding rate of 10 kg/fed produced Rhodesgrass of higher NEF (47.06 %) than the highest seeding rates of 20 kg/fed. • Total Digestible Nutrients (TDN) for Pioneer c.v. of Rhodesgrass was slightly lower (48.28 %) than Katambora (49.79 %). • The highest TDN of Rhodesgrass obtained at the shortest cutting duration period (20 days) was compared with each of the other two longer periods (30 and 40 days). v Lowest seeding rate (10 kg/fed) relatively produced the highest TDN of Rhodesgrass compared to the higher rates (15 or 20 kg/fed).

Second study: Studies on establishment and evaluation of some perennial forage mixtures. The two Rhodesgrass cultivars under evaluation in the first study (Katambora and Pioneer) were grown with alfalfa (Siriver cv.) in the proposed forage mixtures with alfalfa in this study. Each of these plant forage materials was so wn in its pure stand and the proposed mixtures which were based on the recommended seeding rates in their pure stand (20 k: fed for alfalfa and 15 kg/fed for Rhodesgrass). Treatments included: three pure stands of Pioneer; Rhodesgrass cv. katambora; and Alfalfa proposed different mixtures of : 75% alfalfa + 25° cv. Katambora; 75% alfalfa + 25% Rhodesgrass c alfalfa + 50% Rhodesgrass cv. Katambora; 50% Rhodesgrass cv. Pioneer; 25% alfalfa + 75% Katambora; and 25% alfalfa + 75% Rhodesgrass Piodesgrass cv. v. Siriver + 6 Rhodes grass . Pioneer; 50% alfalfa + 50% odesgrass cy. eer c. v Two fertilization treatments were implementation. The low treatment was N25 kg + P15 and the high treatment was N50 kg + P300 kg + K50 kg /fetwo treatments was supplemented with either M essential micronutrients), forming four fertilizat Each of the formulated 4 fertilization treatments distributed for each of the proposed forage mixture stands. .t4selected forkg + K25 kg /fed.,. Each of these or Mo (as an on treatments. were randomly and their pure Results could be summarized as follows: 1. Yearly and total fresh forage yield: • Among the relevant various pure stands, alfalfa was of the highest total fresh yield (111.12 ton/fed/25 cuts/3 years) and almost doubled as compared with either of Rhodesgrass cultivars. Meanwhile, Rhodesgrass cv. Pioneer produced slightly higher fresh yield (66.59 ton/fed/25 cuts) than cv. Katambora (64.26 ton/fed/25 cuts). v Highest fresh total yield potentialities of alfalfa imposed its effect when mixed with Rhodesgrass. As the mixing rate of alfalfa decreased from 75 to 50, then 25%, it caused substantial decrease in alfalfa-Rhodesgrass forage mixtures, where the lowest total fresh forage mixture was for the mixtures that have the least contribution of alfalfa (25%). v Results showed slight superiority of cv. Pioneer than cv. Katambora of Rhodesgrass in their pure stands or in their mixtures with alfalfa. Such result was true in all of the proposed mixtures. v Rhodesgrass cultivars in all of their associations with alfalfa produced significantly higher total fresh fodder yield as compared with its relevant pure stands or mixtures even with the lowest ratio of alfalfa (25%). So, the increase in forage yield potentialities were in favor to grasses rather than alfalfa when associated. v Results proved the efficiency of the selected two high fertilizer treatments (N50+P300+K50) whether supplemented SUMMARY 117 with Mg or Mo in obtaining the highest to 1 fresh forage yield. Those treatments were adequate i fulfilling the adequate requirement for encouraging veget tive growth as compared to either of the two lower ferti izer treatments whether supplemented with Mg or Mo ith significant differences. v Results clarified the most importance role as compared with magnesium in respect of fr production whether

supplemented to the fertilizer treatments. f molybdenum sh forage yield high or low • Superior effect of the supplemented Mo as pronounced with any of the high (N50+-P300±x50) or the low (N25+Piso+K 5) fertilization treatments with significant differences v Total fresh yield decreased significantly alfalfa decreased from 75 to 50, and down mixture with either of Rhodesgracs cultivars. average total fresh yield production was 99 84.51 ton/fed. In such respective mixtures, the ratio of to 25% in the The respective 34, 93.01 and liodesgrass cv • 4. Pioneer was significantly higher in fresh yield as compared with cv. Katambora. • The interaction effect of the proposed forage tands with the selected fertilized treatments on the obtained total fresh forage yield was significant SUMMARY 118 • The best fit of the selected high fertilizer treatment supplemented with molybdenum, especially when the alfalfa ratio increased in the proposed mixtures with grasses. + The distribution of fresh forage production for each year during the stand life (over all of the applied treatments) was 9.39, 42.93, and 35.44 ton/fed for the first, second, and the third year, respectively. • The productivity started to decline slightly in the third year by 14.50% compared to the previous year. iF h the hi h N • Either N50 kg + P300 kg + K50 kg /fed or low N25 kg + P150+ K25 25 kg /fed. fertilizer treatments produced significantly higher forage yield when supplemented with molybdenum rather than magnesium. 2. Seasonal contribution in fresh forage yield: • In general, data of the distribution of total seasonal fresh forage productivity along the stand duration indicated the superiority of autumn, followed by summer, then spring, followed by winter. v Among the reasons for the lowest fresh forage production in winter seasons is the cool temperature especially at night which put alfalfa in a semi dormant condition and reduce any of the associated Rhodesgrass cultivar in an almost complete dormant situation. v Pure alfalfa stands were higher in forage yield as compared with any of Rhodesgrass cultivars. This result was true foreach of the four growing seasons with signifi ant differences and various magnitudes. The average reduction in forage yield production of Rhodesgrasses cultivars compared with alfa fa in their pure stands was about 28 % in summer, 23 % in Wring and 22 % in autumn with significant differences. v Among the proposed forage mixtures of alfa fa and either of Rhodesgrass cultivars, the high sup r productive potentialities of alfalfa imposed its effect on he productivity of the associated proposed forage grasses in t e mixtures. v Regarding the effect of the supplemented m croelements on fresh forage yield, Mo supplementation was more effective than Mg whether with the lower or hig er fertilization treatment during the four seasons with variabl magnitudes. v In conclusion, results varied in its magnitu e according to the cumulated productivity of the season du ing the 3 years of stand longevity which were in the folio ing descending order autumn > summer > spring > winter sea on. 3. Yearly and total dry forage yield: v During the first year of establishment, pure tand of alfalfa produced significant slightly higher dry yiel s as compared with the pure stand of Katambora or Pione r Rhodesgrass cultivars where the yield of both cult vars did not significantly varied. • In the second and third growing year, pure stands of alfalfa produced almost doubled dry fodder yield as compared to either of the grown Rhodesgrass cultivars. In such two years cv. Pioneer was slightly higher in dry yield than cv. Katambora with no significant differences. • Yearly dry forage yield production was offcourse reflected on the simulated total dry forage yield where pure stands of alfalfa, Katambora and Pioneer Rhodesgrass c.v.'s produced 25.01, 14.49 and 15.02 ton/fed/3 years, respectively. It is generally noticed that the total dry yield production slightly decreased as the percentage of alfalfa decreased in the mixture from 75 to 50 and down to 25 %. v This result was also true whether the associated Rhodesgrass was Katambora or cv. Pioneer with significant differences for all cases except with cv. katambora when the Pioneer percentage in the mixture decreased from 75 to 50 %. v At any alfalfa contribution percentage, cv: Rhodesgrass cv. Pioneer produced slightly higher dry yield than cv. Katambora. However, such differences were not significant whether on the total yield or during each of the 3 growing years. Higher complete fertilization Nsokg, -P300kg and K50kg ifed • - treatment whether supplemented with magnesium or molybdenum produced significantly higher total dry forage yield than the low (N25kg, P\_ 150kg and K25kg/fed.) ones during thesecond and third year and the total yield as well, but such increase was not significant during th establishment. first year of 4. Seasonal contribution in dry forage yield: v The distribution of dry forage yield pro uctivity among seasons was the highest for summer seasons 6.35 tons/fed/8 cuts), followed by spring seasons (4.22 tons/ ed/4 cuts), then winter (2.56 ton/fed/4 cuts), then autumn seasons (7.10 ton/fed/9 cuts). Among the four

seasons of the stand duration, pure stand of alfalfa produced much higher dry forage yield as compared with Katambora or Pioneer Rhodesgrass cultivars with significant differences and different magnitudes according to the variations in the environmental factors in different seasons. The average reduction in dry fodder yield of the two Rhodesgrass cultivars compared to alfalfa in their pure stands was 30% in summer seasons, 25% in spring seasons, 18% in autumn seasons. In winter neither of the two Rhodesgrass cultivars produce any dry forage yield while alfalfa produced 4.8 ton/ha. Among the proposed mixtures, as the percentage of alfalfa decreased in the mixture, forage yield (with the associated grass) decreased especially in winter seasons. All of proposed percentage of alfalfa in the mixture, cv. Pioneer in the mixture produced relatively higher forage yield as compared with Katambora Rhodesgrass in the mixture with significant differences at 75 and 50% participation of alfalfa in the mixture during spring season. The high fertilizer treatment (N50kg, 300kg P and 50kg K/ha)-whether supplemented with Magnesium or Molybdenum produced significantly high total dry forage yield as compared with the low ones (N25kg, 150kg P and 25kg K/ha). This result was true in spring and summer seasons during the stand life (3 years). Among the low and the high fertilizer treatments, Molybdenum produced higher dry forage yield of the mixture as compared with Magnesium supplemented. Such difference was significant in all seasons except for winter season where differences were not significant. Total forage yield was affected similarly as an accumulation of the produced cuts during the previously mentioned season. Alfalfa in its pure stand was much higher in yield as compared with each of Rhodesgrass cultivars and as the percentage of alfalfa in the mixture decreased. Also, cv. Pioneer was preferable than cv. Katambora Rhodesgrass. In addition, Molybdenum was a preferred supplement in producing better total dry forage production.

#### 5. Chemical Analysis:

As alfalfa percent of the grown forage mixtures decreased from 75 to 50 and down to 25%, crude protein (CP) content in the respective forage mixture was decreased with a noticeable magnitude. CP contents was 17% for pure alfalfa and mixture of 75% alfalfa. whereas, CP of pure Rhodesgrass was 7%, but CP content for mixtures of Rhodesgrass was 14, 11 and 9%, respectively. Highest CP content of the forage was for pure alfalfa and the lowest percent was for the Rhodesgrass. simultaneously 14% for the Rhodesgrass 5, 50% 75% the pure alfalfa pure stand of. In addition, CP content for the proposed forage mixtures decreased as the alfalfa decreased or as the Rhodesgrass percentage increased in the forage mixture. The two complete, fertilizer treatments (N25kg/ha), (150kg P, 300kg P and 50kg K/ha) either with Mg or Mo did not exert noticeable difference in CP of the obtained forage mixture or the stands. 5kg P, 150kg P and supplemented differences in CP of relevant pure. Crude fiber (CF) content of the grown forage mixture increased gradually as the percentage of Rhodesgrass increased from 25, 50 and 75% where it was about 27, 30 and 32%, respectively. Opposite trend was noticed when alfalfa percentage was increased. The two Rhodesgrass cultivars did not vary in its CF content either in its pure stands or at any of the proposed mixtures with alfalfa. The low or high fertilization treatments (N25kg, 150kg P and 25kg K/ha), (150kg P, 300kg P and 50kg K/ha) did not show any detected effect on the CF content of the produced forage material either in its pure stands or mixtures. The supplementation with Mo was responsible for relatively higher content of CF than Mg in most cases with either the low or the high fertilizer formula with reasonable magnitudes. Within the very low content of Ether Extract (EE) in the pure stands of alfalfa or the two Rhodesgrass cultivars or their proposed mixture, the applied fertilizer treatments or their micronutrient supplementations did not exert any noticeable effect.

#### 4. Within the low fertilizer treatment Mg supplementation exerted relatively higher content of EE in the obtained forage whether in its pure stand or their proposed mixtures as compared with Mo supplementation. Using high fertilizer treatment N50kg, P- 300kg and K-50kg/ha, supplementation of Mo was slightly effective in producing relatively higher EE content of the forage compared with Mg in the pure stands of alfalfa, Rhodesgrass cultivars or their mixtures of 75% alfalfa + 25% Rhodesgrass. In pure stands, both of Rhodesgrass cultivars contained relatively higher Nitrogen Free Extract (NFE) content as compared with alfalfa. Highest percentage of either Rhodesgrass mixtures tended to increase the NFE content with the lowest percentages. No specific trend was noticed for the of fertilizer treatments whether supplemented Mo on the NFE content of the obtained forage. Ash content of alfalfa was slightly higher than Rhodesgrass cultivars in their pure stands. Ash content of the obtained forages was not by the proposed forage mixtures or the a

treatments under circumstances of this study. cultivars in the nt as compared to the two with either  
Mg orer than either clearly affected plied fertilizer