

Revegetation of Retired Farmland: Evaluation of Six Range Grasses Under Three Irrigation Regimes

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Abstract

In July of 1986 and 1987, we seeded buffelgrass, kleingrass, "Catalina" lovegrass, "Cochise" lovegrass, bottlebrush, and sideoats grama grass on retired farmland in the Avra Valley west of Tucson. We seeded these grasses under three irrigation regimes: no establishment irrigation, two establishment irrigations, and four establishment irrigations. Establishment irrigations significantly increased the forage production of the grasses in the first two years of the 1986 planting and in the first year of the 1987 planting. Buffelgrass, kleingrass, and the lovegrasses appear to be promising species for vegetative cover on retired farmland.

Introduction

The main objective of this study is to identify range grasses that will persist as a vegetative cover on retired farmland. Previous range seeding research on retired farmland near Tucson failed to identify any plant materials that would persist on the silty clay loam soil (1).

Another objective is to measure the effect of establishment irrigations on these range grasses.

Materials And Methods

The test site at the Three Points Test Area is a farm that was purchased by the City of Tucson and retired for a water transfer. The soil types in the 1986 study vary from Anthony sandy clay loam to Glendale silty clay loam, and was last farmed in 1984. The 1987 study is on a Glendale silty clay loam, and was last farmed in 1985.

Both of the study sites had solid stands of tumbleweeds (*Salsola kali*). We double disked the tumbleweeds, plowed 10-12" deep, and double disked again. Then we ran borders to separate the plots, and double disked the areas within the plots. This intensive land preparation does not represent the kind of work that would be required when establishing a vegetative cover before retiring the land.

The plot designs are randomized complete blocks, three replications, with each species x irrigation treatment entered as a separate plot. The plots are 20' x 300' in the 1986 study, and 20' x 150' in the 1987 study. The plots are oriented to the land slope to maintain a dead-level grade along the length of the plot, and they parallel the old farm furrows.

In July of each year, we hand sowed buffelgrass (*Cenchrus ciliaris*), kleingrass (*Panicum coloratum*), "Catalina" Boer lovegrass (*Eragrostis curvula*), "Cochise" lovegrass (*E. lehmanniana* Nees x *E. trichophora* Coss and Durr.), bottlebrush (*Antheophora pubescens*), and sideoats grama (*Bouteloua curtipendula*). Only sideoats is native to Arizona; the others all originated in Africa. We selected these grasses because they are known to tolerate high sodium soils and because deep rooting is not essential to their survival. In some cases, we would expect plow layers to impair deep rooting.

Immediately after seeding, we began to apply the establishment irrigations. The irrigation regimes were no irrigation, two irrigations 7 days apart, and 4 irrigations on weekly intervals.

Since July 1986, we have been collecting rainfall, temperature, and humidity data with a hygrothermograph and recording raingauges.

Once the grasses were established for just over one year, we began to measure the standing forage. In order to measure the entire growth for the year, we clip plots in the fall after the plants are dormant. All of the standing grass within random drops of a half-square meter quadrat is clipped and oven dried.

Results And Discussion

1986 Study

The forage data for each species x irrigation combination are presented in Table 1. Buffelgrass, kleingrass, and the lovegrasses were the most productive. The treatments with establishment irrigations also tended to be more productive.

Table 1. Standing forage in the 1986 study for three years after establishment.

Species	Irrigations	1987 Forage -----Kg/Ha, Oven Dry Weight-----	1988 Forage	1989 Forage
Buffel	4	1802 a*	1819 a*	2033 a*
Buffel	2	925 bc	1095 ab	1923 a
Klein	2	705 bc	1064 ab	1253 ab
Catalina	4	992 b	1089 ab	1233 ab
Catalina	2	864 bc	1244 ab	1230 ab
Cochise	2	398 cd	784 bcd	1201 abc
Klein	4	1886 a	1790 a	1157 abc
Cochise	4	462 bcd	909 bc	707 bcd
Buffel	0	0 d	235 cde	392 bcd
Klein	0	0 d	163 cde	253 cd
Catalina	0	0 d	16 de	207 d
Bottlebrush	0	0 d	19 de	7 d
Bottlebrush	2	2 d	8 de	66 d
Cochise	0	0 d	19 de	50 d
Sideoats	4	16 d	23 de	0 d
Sideoats	2	6 d	2 e	0 d
Sideoats	0	0 d	0 e	0 d
Bottlebrush	4	0 d	0 e	0 d
Coefficient of Variation		75.00%	82.24%	87.63%

*Means followed by the same letter within a column are not significantly different at the 0.05 level.

The relative performance of the grass species is very apparent when summarized over all of the irrigation treatments (Table 2.). Buffel, Catalina, and Cochise all increased in their presence during the three years. Klein decreased slightly in 1989, and this may be in response to the lower rainfall in 1989 (Table 4.).

Table 2. Forage production of range grass species in the 1986 study across all irrigation regimes.

Species	1987 Forage	1988 Forage	1989 Forage
	-----Kg/Ha, Oven Dry Weight-----		
Buffel	909 a*	1050 a*	1449 a*
Catalina	619 ab	783 ab	890 ab
Klein	864 a	1006 a	888 ab
Cochise	287 bc	571 ab	653 ab
Bottlebrush	1 c	9 b	47 b
Sideoats	7 c	8 b	0 b
Coefficient of Variation	75.00%	82.24%	87.63%

*Means followed by the same letter within a column are not significantly different at the 0.05 level.

Establishment irrigations significantly increased the forage production of the grasses in the first two years of the study (Table 3.).

Table 3. Effect of establishment irrigation regimes on all range grass species in the 1986 study.

Irrigation Regime	1987 Forage	1988 Forage	1989 Forage
	-----Kg/Ha, Oven Dry Weight-----		
4 irrigations	860 a*	938 a*	855 a*
2 irrigations	483 ab	699 ab	946 a
no irrigation	0 b	75 b	163 a
Coefficient of Variation	75.00%	82.24%	87.63%

*Means followed by the same letter within a column are not significantly different at the 0.05 level.

Table 4. Annual rainfall measured at Raingauge #1, Three Points Test Area.

	1987	1988	1989
	-----centimeters-----		
Annual Rainfal	20.32	31.12	19.05

1987 Study

In the 1987 study, we measured about the same relative performance of the grass species and irrigation regimes (Tables 5, 6, and 7.). However, the overall levels of production are much lower than in the 1986 study. The summer of 1987 was much hotter, drier, and windier than the summer of '86. We were irrigating on 7-day intervals, which was not often enough to keep the soil moist under the 1987 weather conditions. The soil surface baked into a crust between the irrigations, killing many of the seedlings.

Table 5. Standing Forage in the 1987 study for two years after establishment.

Species	Irrigations	1988 Forage ----Kg/Ha, Oven Dry Weight----	1989 Forage
Buffel	2	466 ab*	582 a*
Catalina	4	833 a	538 ab
Buffel	4	524 ab	524 ab
Cochise	4	549 ab	435 abc
Catalina	2	332 bcde	369 abcd
Cochise	2	22 de	235 abcd
Klein	2	436 bc	320 abcd
Klein	4	408 bcd	230 abcd
Bottlebrush	2	0 e	198 abcd
Sideoats	4	24 de	154 bcd
Klein	0	59 cde	151 bcd
Cochise	0	0 e	147 bcd
Catalina	0	0 e	109 cd
Buffel	0	44 de	79 cd
Bottlebrush	4	11 e	45 cd
Sideoats	2	7 e	26 cd
Sideoats	0	0 e	0 d
Bottlebrush	0	0 e	0 d
Coefficient of Variation		108.04%	110.06%

*Means followed by the same letter within a column are not significantly different at the 0.05 level.

Table 6. Forage production of range grasses in the 1987 study across all irrigation regimes.

Species	1988 Forage -Kg/Ha, Oven Dry Weight-	1989 Forage
Buffel	345 ab*	395 a*
Catalina	388 a	339 a
Cochise	190 ab	272 a
Klein	301 ab	203 a
Bottlebrush	4 b	81 a
Sideoats	10 b	60 a
Coefficient of Variation		110.06%

*Means followed by the same letter within a column are not significantly different at the 0.05 level.

Table 7. Effect of establishment irrigations regimes on all range grass species in the 1987 study.

Irrigation Regime	1988 Forage -Kg/Ha, Oven Dry Weight-	1989 Forage
4 irrigations	392 a*	321 a*
2 irrigatio	210 ab	273 a
no irrigation	17 b	81 a
Coefficient of Variation	108.04%	110.06%

*Means followed by the same letter within a column are not significantly different at the 0.05 level.

Our experience with the 1987 study showed us the importance of adjusting the establishment irrigations to meet the weather conditions. Greenhouse studies also showed the effect of wet-dry cycles on the establishment of grass seedlings (3,4), and our weekly irrigations failed to keep the soil surface moist in the 1987 study.

Because of this experience, we changed our 1988 and 1989 range grass studies. We removed the irrigation variable, and irrigated all plots as often as necessary to keep the top centimeter of soil moist until the plants established. Data from the 1988 study are in an accompanying article. We also studied the effects of establishment irrigations and microcatchment water harvesting in a separate series of experiments, which is in another accompanying article.

Acknowledgements

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Literature Citations

1. Cox, J.R. and R.M. Madrigal. 1988. Establishing Perennial Range Grasses on Abandoned Farmland in Southeastern Arizona. *Appl. Agric. Res.* 3:36-43.
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