EVALUATION OF WINTER PLANTING OF DORMANT HYBRID BERMUDAGRASSES

by

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ABSTRACT

Tifgreen and Santa Ana hybrid bermudagrass were planted October through April to study the feasibility for off-season establishment of these grasses. Factors evaluated were sodding and plugging with and without overseeding. Sodding without overseeding was generally the best method of establishment. Tifgreen was found to produce the largest spring root mass while Santa Ana produced the largest fall root mass. This suggests Santa Ana as the preferred variety for late fall establishment and Tifgreen for early spring. The major advantage of off-season plantings of hybrid bermudagrass is that the date of establishment and general use during the following summer may be advanced as much as one month compared to conventional warm season establishments.

INTRODUCTION

Hybrid bermudagrass lawns are a popular landscape ingredient for urban areas in the southwest. Because these grasses do not produce seed, they must be vegetatively planted by any of several different methods. Planting is generally done during the warm months of the active growing season, although overseeded sod has been planted to a lesser extent in the winter months.

If off-season planting were readily feasible, the landscape and construction industries could benefit from one time lawn preparation whenever construction was completed without waiting until warmer months to sod warm season grasses. There would also be benefits from reduced dust and erosion of bare ground in new developments. In addition sod farms would have a market for dormant hybrid sod without the expense of overseeding. Private landscapers could benefit by year round planting of these grasses, reducing seasonal backlogs and off-season layoffs.

In this study two popular varieties of hybrid bermudagrass ('Tifgreen' and 'Santa Ana') were transplanted periodically during the late fall, winter, and early spring months to study several factors relating to the feasibility for off-season planting of these grasses.

LITERATURE REVIEW

The effects of transplanting warm season sod during winter months when growing conditions are unfavorable have not been studied to any degree. Transplanting sod is most successful when there are 3 to 4 weeks of favorable growing conditions for rooting (1). Gibeault (5) has reported that warm season grasses make their best shoot and root growth at 26.6 to 29.5 C (80-85F) and 24 to 29.5 C (75-85 F), respectively. Minimum temperatures for growth of warm season grasses have been established at 10 to 15.5 C (50-60 F) (5). Therefore, most transplanting of warm season turfgrass species in the southwest has been done during the period of April through November. Overseeding of these grasses with cool season species is done in September and October.

Beard (3), however, states that sod can be transplanted anytime during the year provided adequate moisture levels can be maintained by irrigation. Traffic control (2) is another important factor to be considered when transplanting during the active growing season and will probably be even more important for dormant sod transplanting.

Fertilizer placement is also an important consideration for transplanting sod. Foote (4) concluded that fertilization increased "sod knit," a term he defined as

"The growth of grass roots from a transplanted turf section into the underlying soil" (p. 965). For bluegrass he found that a split appliction to provide one-half the normal rate under the sod and one-half on top was the most effective.

Soil mixes can also be an important factor in root development of transplanted sod. Letey et al. (6) found that various amendments of peat, lignified redwood, and calcined clay affected both depth of root penetration and the type of root system (fine vs. dense, etc.) which developed.

Overseeding may or may not become an important factor for winter sod transplanting of warm season species. Schmidt and Shoulders (8) stated that during midwinter, overseeded ryegrass populations increased in relation to summer cultivation frequency. Depth of cool-season grass root growth was reduced due to apparent excess moisture retained in early fall when excess thatch was not removed. This could become important for late fall and winter transplanting and overseeding.

METHODS AND MATERIALS

Two trials were initiated at Cortaro, Arizona, approximately 16 kilometers (10 miles) north of Tucson, during the winter of 1973-74 to study the feasibility of winter transplanting of warm season turfgrass sod. The soil in the planting area is Anthony gravelly sandy loam (9) formed in an alluvial fan adjacent to the Santa Cruz River.

Tifgreen and Santa Ana (Cynodon spps.) hybrid bermudagrass, furnished by Cal-Turf[1], was planted each month beginning in October, 1973, and ending in March, 1974. Tifgreen and Santa Ana plots were established in separate areas with treatments in each area arranged factorially in a randomized block design. The trials were situated such that the Santa Ana plots received some late afternoon shade and the Tifgreen plots some early morning shade, but these differences were considered insignificant. There were six planting dates within each of five blocks for each cultivar. Other factors evaluated were overseeding vs. non-overseeding and sodding vs. plugging.

Individual plot size was 115 cm x 76 cm (664 cm^2), or 45 in x 30 in (9.37 ft^2). Sod was planted to completely

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1. Formerly Maricopa Turf, an affiliate of Cal-Turf, currently Western Sod, a sod farm at Casa Grande, Arizona.

cover sodded plots. Six square plugs, each approximately 26 cm^2 (4 in^2), were hand planted and evenly spaced in each plot to provide a cover of approximately four per cent. Each plug was ruler measured and hand cut. Plots were overseeded at the rate of 562 kg/ha (10 lb/1,000 ft^2) with annual ryegrass (Lolium multiflorum L.), at planting time. At each planting, nitrogen was applied to all newly seeded plots at the reate of 0.24 kg/100 m^2 (1/2 lb/1,000 ft^2) in the form of ammonium sulfate and thereafter only on overseeded plots at each planting date. Fertilizer application was not considered as a treatment at this time because dates and type of transplanting were factors that needed first consideration. Trials were watered twice weekly or as required depending on rainfall and other weather conditions.

Plots in each trial were sodded and plugged on October 14, November 16, and December 17, 1973; and January 19, February 17, and March 15, 1974. At each planting date, pots 11 cm (4.5 in) in diameter by 13 cm (5 in) deep were filled with unwashed river sand, covered with a 1/8" hardware cloth screen, and placed below the sod at ground level in all sodded plots. These were removed at each succeeding planting date and on April 15, one month after the last planting date. The sod was cut vertically around each pot, and horizontally just above the hardware cloth. The pot contents were air dried and sieved through a 2 mm screen.

Material passing the sieve did not contain significant amounts of root material and was not retained. The remaining material was then washed to remove soil and gravel and the roots hand separated from foreign matter, dried, and weighed.

Plugged plots were first evaluated in April by hand measuring the size of each plug and comparing it to the initial size. Visual ratings were made on sodded plots in March, April, and May of 1974. Ratings were made on a scale of 1 to 10 (1 poorest, 10 best) and considered the following combined factors: color, density, and grass vigor as well as overall condition.

Temperature and rainfall for Cortaro were normal for the trial months in both 1973 and 1974 (7). Average monthly temperatures for the trial period were: October 22.9 C (72.2 F), November 14.7 C (58.5 F), December 10.3 C (50.6 F), January 10.7 C (51.2 F), February 10.7 C (51.2 F), March 10.6 C (51.1 F), and April 18.6 C (65.4 F), with none of the months departing from normal. Cortaro received no rain in October, 2.31 cm (.91") in November, none in December, 1.70 cm (.67") in January, .25 cm (.10") in February, 2.62 cm (1.03") in March, and none in April. Cortaro did not experience a temperature below 0 C (32 F) until November 19 and had no temperature below -7.2 C (19 F) (December 20) in 1973. The low for January was -2.8 C (27 F) and the February low was -7.2 C (19 F). March had a low of -1.1 C (30 F) and

only 3 days below 0 C (32 F). April had a low of 0 C (32 F) (one day) and there were 5 days of 32.2 C (90 F) or above.

RESULTS AND DISCUSSION

Turf sodded in October received a sufficient period of favorable growing conditions to become well established prior to the first frost (November 19) and subsequent normal dormancy. Although late fall temperatures were lower than the optimum (24 to 29.5 C) for bermuda growth, comparison of December root weights for October and November sodding shows considerable root growth occurred prior to the first sampling in December (Table 1). Fall root growth by the earliest sodded turf was sufficient to provide a firm attachment to the soil before winter. Root growth during the experimental period varied depending on turf variety, sodding time, and time of year as discussed below.

Fall Sodding

The magnitude of fall root growth is indicated by comparison of root weights (averaged over varieties) for turf sodded in October and December (Figure 1). Measurements taken in December showed that turf sodded in October produced a measurable amount of root mass (0.7 g) while that sodded in November apparently remained in a dormant state (0.0 g) until early spring. Although differences in root mass were measured from December until March, significant growth did not occur until April (Table 1), and then only

Table 1. Mean* dry root weight of non-overseeded hybrid bermudagrass measured following off-season sodding.

Month Sodded	Month Sampled				
	Dec.	Jan.	Feb.	Mar.	Apr.
	grams				
October	.709C	.793C	.763C	.663C	.723Cb
November	.000A	.009A	.040A	.133A	.386Ba
December		.000	.000	.074	.441 a
January			.000	.010	.592ab
February				.013	.358 a
March					.379 a

*Values are an average for both Santa Ana and Tifgreen each replicated five times. Values followed by the same letter are not significantly different at the 0.05 probability level. Upper case and lower case letters represent separate statistical comparisons.

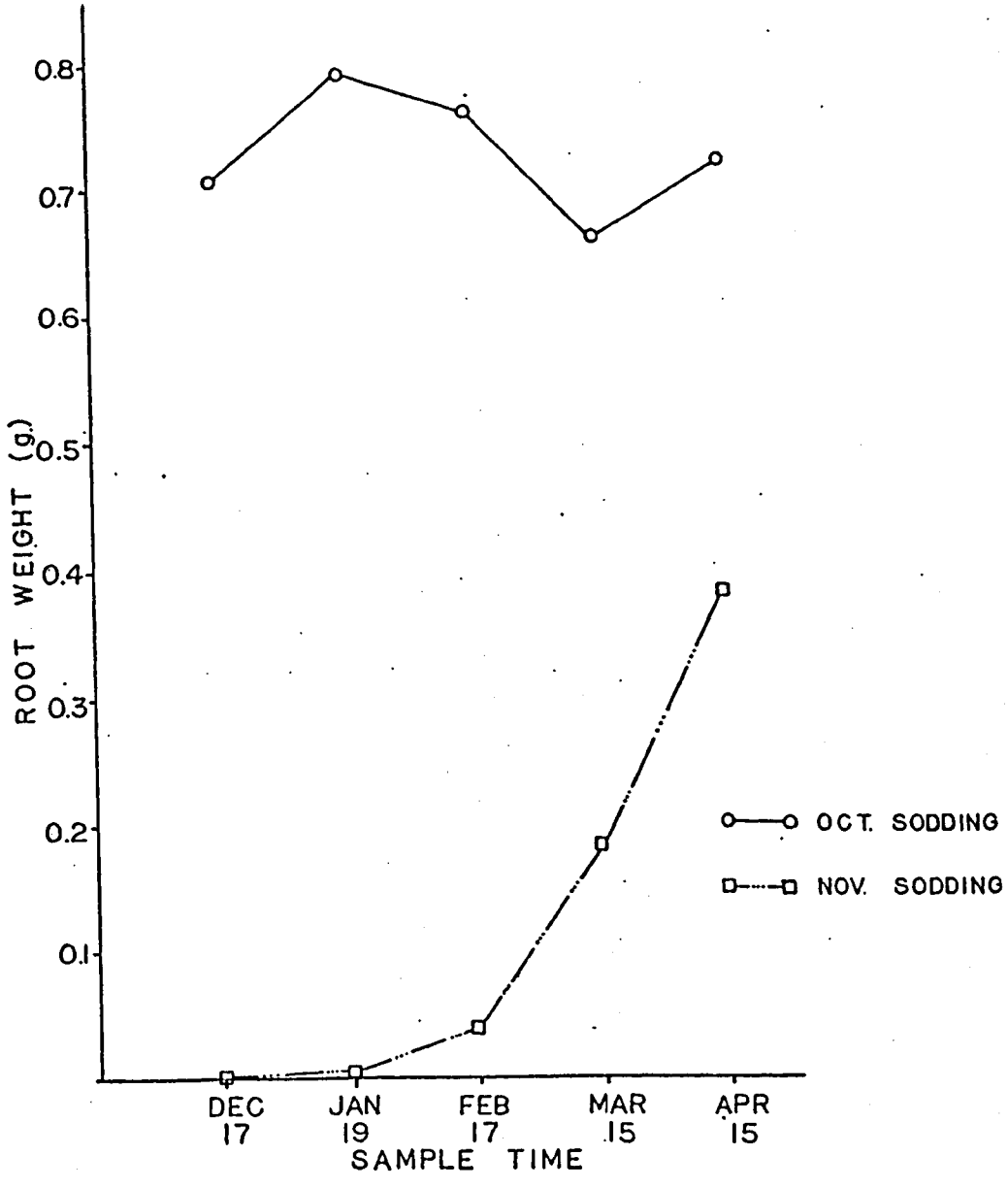

Figure 1. Root weights for October and November sodding dates as sampled December through April.

for the November sodded turf. Root weights of October sodded turf fluctuated above and below the first measured values but did not change significantly during the remainder of the study.

Turf sodded in November began to produce measurable root mass in January and continued to increase in root development with time. Root mass produced by the April sampling time was significantly greater than that at previous samplings. Although significant spring root growth occurred for the November sodded turf, the total mass was significantly less and only slightly more than half that produced by the October sodding. These results suggest that a nearly complete root system was developed in the fall for the October sodded turf (spring growth precluded by fall growth). Apparently spring root growth is strongly influenced by the existing root system and/or the degree to which it has developed.

All Sodding Dates

As previously discussed, the October planting produced a significant amount of root mass prior to beginning dormancy. Root masses measured in April were highest for this sodding date. April measurements of root mass in turf sodded during the winter months indicate that significant amounts of root mass were not produced by sod planted after October and before March (Table 1). This becomes evident

when spring growth (values for the March sodding) is subtracted from the values for the other sodding dates.

Visual ratings of turf quality taken in March and April show significant increases in quality ratings in April for all sodding and plugging dates (Figure 2). Considering slightly better April weather compared to March this trend should be expected. There were only minor differences in ratings among planting dates except for January and February (Table 2). The January and February planting dates were rated significantly better than other dates for the April evaluation. The high rating for January coincides with the high root weights obtained for the January sodding (Table 1). A comparison with visual ratings on dormant sod not transplanted taken at the same period was not made but would have been of interest.

Night temperatures were never lower than -2.8 C (27 F) during January (as compared to lows of -7.2 C [19 F] for both December and February) which may have been a factor in the higher root mass measured for January sodded turf. However, the more favorable temperature observed in January apparently was not singularly responsible for the greater root growth by sod planted during this month since similar amounts of root mass were not measured for earlier planted sod. Perhaps the sod cutting and transplanting operations in conjunction with the warmer temperatures are responsible for the January response. Roots in cut sod and newly

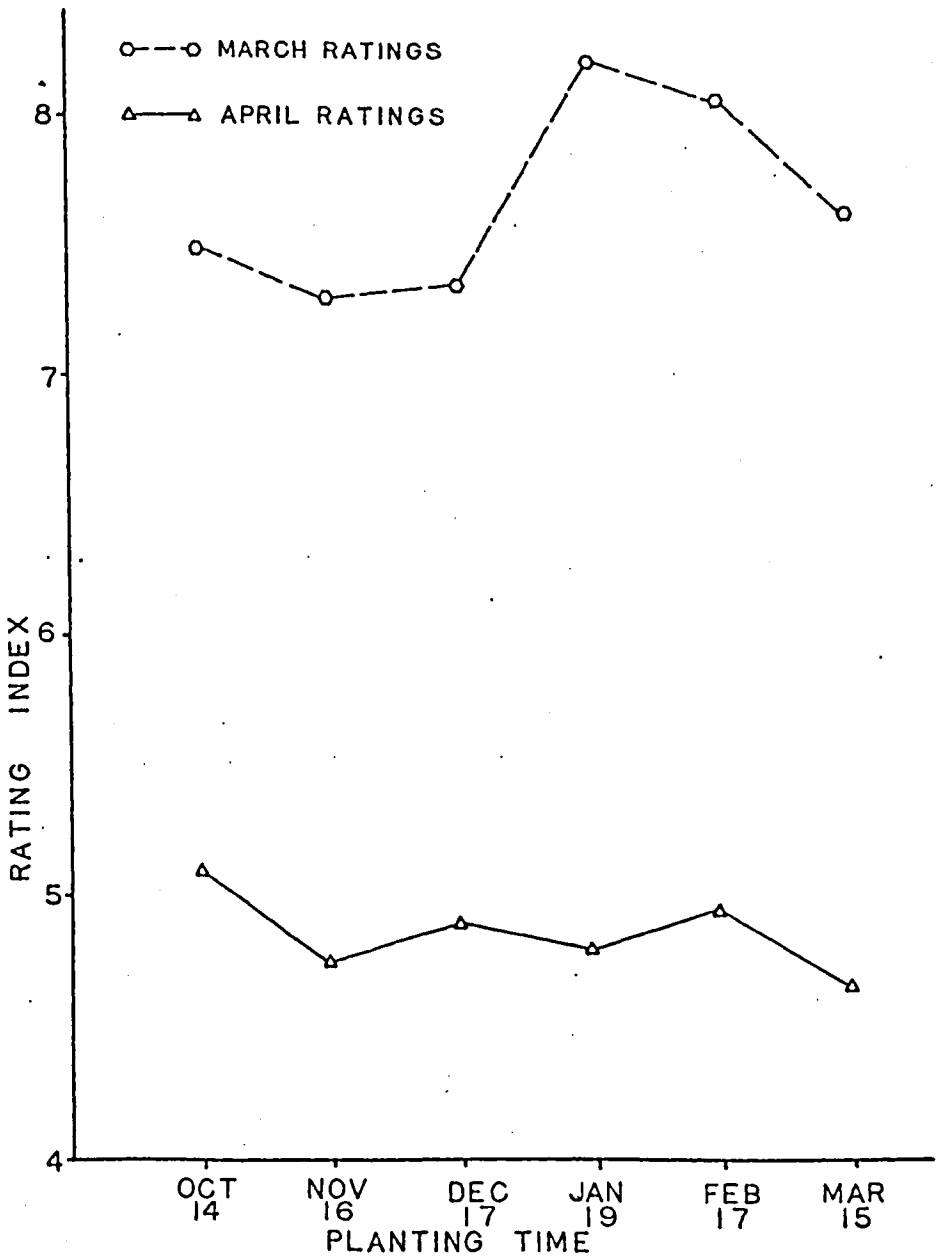

Figure 2. Visual ratings averaged over all treatments taken in March and April.

Table 2. Turf quality visual evaluations* of off-season plantings (sodded and plugged) of Santa Ana and Tifgreen bermudagrasses.

	Planting Time					
	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.
	Rating					
Variety						
Santa Ana	6.45 bcd	5.95 ab	5.95 ab	6.50 bcd	6.70 d	5.65 a
Tifgreen	6.15 abcd	6.10 abc	6.30 bcd	6.50 bcd	6.30 bcd	6.60 cd
Evaluation Time						
March	5.10 a	4.75 a	4.90 a	4.80 a	4.95 a	4.65 a
April	7.50 b	7.30 b	7.35 b	8.20 c	8.05 c	7.60 b

*Values followed by the same letter are not significantly different at the 0.05 probability level. Variety values are an average of the March and April evaluation dates. Values for the comparison of March and April evaluation dates are an average of the two varieties. The variety comparison is separate from the evaluation time comparison.

transplanted sod would be expected to warm up faster than those in the field because drying and improved aeration with these operations would lower the soil heat capacity.

Perhaps the optimum time for off-season sodding of dormant sod is just prior to or at the beginning of expected warm periods.

Varieties

In comparing root growth of the two varieties used in the trial for non-overseeded treatments, results (Table 3) showed that for the October sodding Santa Ana produced a significantly larger root mass (0.850 g) by April than Tifgreen (0.596 g). Santa Ana apparently produced most of its root mass in the fall, as indicated by both the difference in April measurements of October and November sodding treatments and the difference in December root mass of the varieties sodded in October. However, for the November planting Santa Ana showed a significantly large decrease (from .850 to .324 g) in root mass produced by April, while the root mass produced by Tifgreen decreased only slightly (from .596 to .448 g). This can be related to differential varietal response to the temperatures for October and November. October averaged 22.9 C (72.2 F) whereas the November average temperature was only 14.7 C (58.5 F), a difference of 8.2 C (13.7 F) and well below the optimum for bermudagrass growth.

Table 3. Mean* dry root weight of non-overseeded Tifgreen and Santa Ana hybrid bermudagrasses measured following off-season sodding.

Sodding Date	Sampling Date				
	Dec.	Jan.	Feb.	Mar.	Apr.
	grams				
		Tifgreen			
October	.338A	.402A	.396A	.398A	.596Aa
November	.000	.010	.026	.190	.448 a
December		.000	.000	.092	.480 a
January			.000	.008	.590 a
February				.020	.324 a
March					.596 a
		Santa Ana			
October	1.080A	1.180A	1.130A	.928A	.850Ad
November	.000	.006	.054	.076	.324 ab
December		.000	.000	.056	.402 bc
January			.000	.012	.594 c
February				.006	.392 bc
March					.162 a

*Values are an average of five replications. Means followed by the same letter are not significantly different at the 0.05 probability level. Upper case and lower case letters represent separate statistical comparisons within each variety.

The approximately three times greater root mass produced by Santa Ana (1.08 g) as compared to Tifgreen (.338 g) for October sodding measured in December indicates that the former variety is considerably more active during late fall cool temperatures. This finding suggests that Santa Ana would be better suited for late fall sodding than Tifgreen. Conversely, the significantly higher root mass produced by Tifgreen in April, 0.596 g compared to 0.162 g by Santa Ana, for March sodding suggests that Tifgreen would be the more desirable variety for early spring establishment. Visual ratings of the March 15 sodding taken March 31 support the root mass data. Tifgreen had a significantly higher rating than Santa Ana, 6.60 compared to 5.65 (Table 2).

Comparison of the April root mass for the two varieties and all sodding dates (Table 3) shows no real difference among the values for Tifgreen. Apparently this is a result of the rapid early spring growth by this variety. Early spring growth by Santa Ana, however was only slight (0.162 g) and this root mass was significantly less than April root masses for the December, January, and February sodding dates. This finding suggests that the minimal winter growth by both varieties contributes significantly to early spring root growth only for the Santa Ana variety.

Overseeding

Non-overseeded plots had significantly higher root weights than overseeded plots for both varieties for November through January but root masses were similar thereafter (Table 4). There are several possible explanations for this. Ryegrass germination was poor on all dates, but particularly so on the January through March dates. Hence, the contribution by ryegrass to the total root mass would be expected to be small in general. Some plots had to be reseeded and still did not have a good rye cover. Cover was also extremely uneven within each plot. Perhaps the lack of establishment and root growth could relate to Schmidt and Shoulders (8) findings, although visual inspection did not show excess thatch in the transplanted sod. Lack of bermudagrass root growth equal to that which occurred in the non-overseeded plots can only be explained by competition or antagonism by the ryegrass. Considering the problems encountered few other interpretations can be made from the overseeding data.

Plugging

Plug diameters (averaged over April and May measurements) indicate that the October plugging produced significant growth and increased coverage by spring. There was a definite decrease in growth for the remainder of the dates with quite a bit of fluctuation in the values averaged

Table 4. April root weights* of overseeded and non-overseeded hybrid bermudagrasses sodded November through March.

Treatment	Sodding Date				
	Nov.	Dec.	Jan.	Feb.	Mar.
	----------g----------				
Overseeded	.071 a	.124 a	.270 ab	.465 bc	.274 ab
Non-overseeded	.386 b	.441 bc	.647 c	.358 b	.379 b

*Values are an average of Tifgreen and Santa Ana bermudagrass varieties. Values followed by the same letter are not statistically different at the 0.05 probability level.

over varieties (Table 5). November, January, and February plugging dates had significantly higher values than either December or March dates, but were lower than for October. Tifgreen had significantly larger spring diameters than Santa Ana for all months except the February plugging (Table 5). Visual ratings comparing sodding and plugging showed Santa Ana sod significantly better than plugged Santa Ana, but for Tifgreen, plugging showed significantly higher values than sodding. Not enough variables were measured to be able to compare sodding and plugging to a greater degree.

Some weeds were present on all plots, but infestation was a problem mainly on the plugged plots, particularly

Table 5. Plug diameters of Tifgreen and Santa Ana bermudagrass planted October through March and measured in April and May.*

Variety	Planting Date					
	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.
	cm					
Santa Ana	13.08 d	9.14 b	5.33 a	10.41 bc	12.70 cd	6.86 a
Tifgreen	17.53 f	16.51 f	15.49 ef	13.59 de	13.72 de	11.56 cd
Average	15.29 c	12.83 b	10.41 a	11.99 b	13.21 b	9.19 a

*Values are an average of the April and May measurements. Values followed by the same letter are not significantly different at the 0.05 probability level. Underscored and non-underscored letters indicate separate statistical comparisons.

on those which were not overseeded. Non-overseeded sodded plots also had more weeds than overseeded sodded plots. The weed problem may have been aggravated because all plots received water at the rate felt necessary for the overseeded plots.

A problem on plugged plots was the failure of plugs to become firmly established in the ground until the spring growing season. Plugs could easily be disturbed until March except where some ryegrass germination occurred on the overseeded plots.

CONCLUSIONS

Winter sodding of dormant hybrid bermudagrass appears to be a highly feasible means of establishing permanent bermudagrass turf. Sodding is generally better than plugging because the complete cover of sod lessens the chance for weed infestation and plugs planted in late fall are subject to dislodgement even by minimum traffic. Overseeding of the sod would offer competition against weeds in some areas and prevent possible dessication because it would require maintenance irrigation. As long as moisture is supplied via regular irrigation however, overseeding does not appear essential. Information on required irrigation amounts and suitable methods is still lacking. In the arid southwest, irrigation should be an important factor to be considered when winter transplanting.

In this study the highest root mass produced by April from winter planted sod was for the January sodding and was associated with unseasonably warm temperatures. This finding implies that the optimum time for off-season transplanting of hybrid bermudagrass is just prior to the beginning of warm weather. Visual observations of turf quality generally supported the above data. Another point of interest in the study was the spring-fall differences in root weights of Santa Ana and Tifgreen. Tifgreen produced

more root mass in the spring while Santa Ana produced more root mass in the fall. These results suggest Santa Ana as the preferred variety for late fall establishment and Tif-green for early spring.

A major problem observed with winter transplanting of dormant bermudagrass turf was that of weed competition, but proper seedbed preparation to eliminate or retard weeds and/or overseeding helps to combat this.

The major advantage of off-season plantings of hybrid bermudagrass is that the date of establishment and general use during the following summer may be advanced as much as one month as compared to conventional warm season establishment.

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