EFFECT OF STUBBLE HEIGHT ON REGROWTH OF SMOOTH BROMEGRASS SELECTIONS COMPARED WITH ORCHARDGRASS AND REED CANARYGRASS [1]

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ABSTRACT

Smooth bromegrass (*Bromus inermis* Leyss.) strains selected for regrowth were compared with 'Nordstern' orchardgrass (*Dactylis glomerata* L.) and 'Rise' reed canarygrass (*Phalaris arundinacea* L.) in an experiment established from seed in the fall of 1972 and harvested on June 5 the following year. Fifteen days after harvest stubble heights and regrowth from the stubble were measured. Forage yields were taken on July 12. Orchardgrass significantly exceeded all other cultivars in regrowth height after 15 days and in yield in the subsequent harvest. The regression of regrowth height on stubble height was linear for orchardgrass, but the slope of the line was not as steep as that of some of the smooth bromegrass cultivars. Orchardgrass and reed canarygrass produced the highest and second highest regrowth height and yield of all cultivars despite a low stubble height. A higher stubble height favored regrowth of smooth bromegrass selections ($r = .44$), but considerable differences among selections were found. Correlations of .91** and .83* respectively between height 15 days after harvest and yield on the next cutting were obtained with the inclusion of orchardgrass and reed canarygrass and with the bromegrass selections alone. Therefore, regrowth height at 15 days was a good indicator of relative subsequent forage yield. It was concluded that small differences in stubble height have significant effects on regrowth yield, and that the effect of stubble height on regrowth had different relative importances among the three species and also among the bromegrass selections.

INTRODUCTION

Grasses grown for pasture should have the ability to produce abundant regrowth through rapid recovery after harvest. Smooth

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bromegrass (*Bromus inermis* Leyss.) enters midsummer dormancy which reduces yields despite precautions taken in the fall and spring to ensure regrowth (6). Some of the reasons for this slow recovery have been previously discussed (4). Smith, Jacques and Balasko (5) found that, in mixtures with alfalfa, bromegrass yielded less than and did not persist as well as orchardgrass (*Dactylis glomerata* L.) or reed canarygrass (*Phalaris arundinacea* L.) under a multiple cutting regime. Also, a lower stubble height significantly reduced bromegrass stands. Stubble heights of bromegrass of 10 to 13 cm have been shown to yield significantly more regrowth than heights of 4 to 5 cm (3). In this study the effects of smaller differences in height similar to those that may occur under pasture situations were evaluated.

MATERIALS AND METHODS

Fourteen smooth bromegrass genotypes selected for regrowth from the 'Saratoga' cultivar as described by Gross (2), were vegetatively propagated in three isolations in the field in 1972. Seven, four, and three genotypes were used as parents of synthetics, designated Experimentals No. 1, No. 2, and No. 3, respectively. Seed was harvested in late July and planted in comparison with 'Rise' reed canarygrass, 'Nordstern' orchardgrass, Syn 2 Saratoga and open pollinated seed from two smooth bromegrass genotypes (1A-34-40 and 3E-8-23) also selected from Saratoga for regrowth ability. A randomized complete block design with four replications was used. Seed was planted at a rate of 11 kg/ha in plots 2.4 meters square each containing eight rows with 30 cm spacing. Alleys of 1.5 M and borders were seeded with South Dakota 8, an experimental synthetic lacking regrowth ability. Ammonium nitrate (34-0-0) was applied in April 1973 at a rate of 224 kg/ha. Stands were thinned to equal levels within each replicate in May 1973. On June 5 forage within a 1 m square in the center of each plot was cut with a hedge trimmer. Fertilizer (34-0-0) at a rate of 168 kg/ha was applied immediately after harvest. Moisture was maintained by sprinkler irrigation. Fifteen days after harvest, 25 measurements of stubble height and regrowth height from the ground to the leaf tip were taken within each plot for each of the 4 replicates. Best fitting regression equations, either linear or curvilinear, were determined for the effect of stubble height on regrowth for each selection. A second harvest was taken 37 days after the first, on July 12, and then oven dried and weighed.

RESULTS AND DISCUSSION

Significant differences among cultivars were found for stubble and regrowth height 15 days after first harvest on June 5 and for yield 37 days later (Table 1). Orchardgrass made the most growth during the 15 day interval and also significantly out-yielded the

TABLE 1

Mean Measurements of Stubble and Regrowth Heights 15 Days After First Harvest and Mean Yields for Subsequent Harvest, 37 Days After the First

	Stubble ht, cm (X)		Regrowth ht, cm (Y)				
	Mean†	Range‡	Mean†	Range‡	R^2‡	Regression of Y on X‡	Yield, kg/ha$
Orchardgrass	5.3 bcd¶	2-15	29.4 a¶	13-55	.11	$Y = 22.15 + 1.38X$	4,288 a¶
Reed canarygrass	5.1 d	2-17	22.6 b	9-35	.17	$Y = 13.16 + 2.54X - .11X^2$	3,363 b
3E-8-23 bromegrass*	5.9 a	2-19	20.1 bcd	9-35	.34	$Y = 25.87 - 7.80X + 1.95X^2 - .16X^3$	3,360 b
Exp #2 bromegrass	5.7 abc	3-15	21.3 bc	8-39	.21	$Y = 12.76 + 1.50X$	2,923 bc
Exp #3 bromegrass	5.8 ab	3-14	21.9 b	5-43	.09	$Y = 9.60 + 3.39X - .19X^2$	2,880 bc
Exp #1 bromegrass	5.8 ab	2-17	19.4 cd	9-40	.19	$Y = 12.20 + 1.24X$	2,810 c
Saratoga	5.2 cd	3-11	19.5 cd	8-43	.12	$Y = 11.82 + 1.47X$	2,800 c
1A-34-40 bromegrass*	5.5 bcd	1-12	19.1 d	7-40	.11	$Y = 12.91 + 1.11X$	2,763 c

* Open pollinated seed from a genotype selected for regrowth.
† Four-replicate means of 25 measurements per plot.
¶ Duncans multiple means test.
‡ Based on 100 measurements.
$ Four-replicate means.

other cultivars. The mean stubble height of orchardgrass was not significantly different than the bromegrass material selected for regrowth.

Branson (1) indicated that, under grazing, species whose shoot apices remained near ground level increased in stand while those with higher apices decreased in stand. In orchargrass the shoot apex was not removed by cutting in this experiment, so this might explain its faster response compared with smooth bromegrass.

Orchardgrass regrowth took place from the top of the stubble, while in both reed canarygrass and bromegrass new tillers produced the regrowth. While the slope of the regression line of orchardgrass was not as steep as that of Saratoga or Exp. #2, its Y intercept was much larger. This and the size of the coefficient of determination R^2 indicate that stubble height was not as important in influencing regrowth height of orchardgrass, despite a linear relationship, as it was in some of the smooth bromegrass cultivars. Sheard and Winch (4) found that species such as smooth bromegrass in which the growing points elongate are at a disadvantage when harvested frequently in mixtures with legumes. Orchardgrass, which has a growing point that does not elongate in this manner, will yield more under frequent cuttings and will persist in a mixture.

Reed canarygrass had the lowest stubble height in this study yet significantly outyielded five of the smooth bromegrass cultivars. This may suggest that reed canarygrass may be able to grow back with a lower stubble height than the other grasses. Nevertheless, stubble height is still important, as indicated by the comparative size of R^2 indicating the proportion of variability accounted for in the regression equation.

The correlation coefficient of stubble height and regrowth height of the different smooth bromegrass cultivars was .44, but the R^2 values varied greatly indicating that stubble height appeared to be more important in some entries than in others. All bromegrass entries in this study recovered slowly after harvest compared with orchardgrass; three cultivars were significantly slower than reed canarygrass. Harvesting with the hedge trimmer to such low stubble heights removes all the leaves from smooth bromegrass. This grass must make its regrowth from new tillers; therefore the photosynthesizing surface may assume great importance in determining regrowth since carbohydrate root reserves would be low under these conditions. Cultivars, however, did differ in their apparent dependence upon the amount of photosynthetic surface available after cutting, indicating that root reserves might be greater in some cultivars than in others. Nielsen, Drolsom, and Voigt (3) did not find a difference between genotypes in their ability to withstand low cutting as indicated by lack of significance of genotypes X height of cutting. The cultivars in the present study, however, have been selected for regrowth so they might be expected to show different degrees of dependency on cutting height.

A correlation of .91** was obtained between means for regrowth heights and yield in the next harvest when all entries were included. When only the bromegrass selections were included, a correlation coefficient of .83* was obtained. This indicates that height of regrowth at 15 days has considerable importance in determining yield of these selections.

From this experiment it is evident that the ability for rapid regrowth characteristic of orchardgrass, due to its basally located growing point, will be difficult to equal in smooth bromegrass which has to make its new growth from a tiller primordium. The speed of this regrowth in bromegrass will depend on the amount of stubble left and also on the root reserves and vigor of the plants. In conclusion, it appears that small differences in stubble height may result in significant variations in both height of regrowth and dry matter yield at harvest.

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