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THE INFLUENCE OF DOMESTIC
RYEGRASS AND REDTOP UPON THE
GROWTH OF KENTUCKY
BLUEGRASS AND CHEWING'S
FESCUE IN LAWN
AND TURF MIXTURES

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THE INFLUENCE OF DOMESTIC RYEGRASS AND REDTOP
UPON THE GROWTH OF KENTUCKY BLUEGRASS AND CHEWING'S FESCUE
IN LAWN AND TURF MIXTURES

by

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THE INFLUENCE OF DOMESTIC RYEGRASS AND REDTOP
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INTRODUCTION

The inclusion of large percentages of so-called "nurse grasses" in lawn seed mixtures is a common practice. Grasses such as domestic ryegrass and redtop have an advantage over the desired turf grasses in that they are quicker starting; thus producing green cover sooner, reducing the time that the soil is left bare, and cutting down on possible erosion. However, these "nurse grasses" inhibit the growth of the desired grasses and, once past the seedling stage, have the disadvantage of being coarse and rough; they do not produce the fine turf which is desired.

In an ideal mixture, the "nurse grass" should get an early start, not be unduly competitive, and should disappear entirely after one seasons time, allowing the desired grass to dominate an early stage. This does not happen in practice however. The "nurse grass" dominates for the first season and very often persists for several seasons; thus taking several years to establish a turf which is free of coarse grasses. Consequently it is frequently advisable to use a pure species or a mixture of desired grasses and to omit the faster growing, coarse nurse grasses from the

mixture. If a "nurse grass" is to be used, the percentage in the seed mixture should be at a minimum which will produce an initial cover but yet not unduly retard the growth of the desired grass or grasses.

An experiment was designed to study the effect of two common nurse grasses on the establishment and growth of the finer turf grasses, and in this way help to determine the grass seed mixture which would produce the best turf. The ratio between the grasses in seed mixtures, the rate of seeding, and any inhibiting effect which one grass had upon another were to be studied and observed.

REVIEW OF LITERATURE

Relatively few studies have been made showing the specific competitive effect of various grasses upon each other in turf mixtures, most studies having dealt with a pure species of grass. However, considerable work has been done with pasture mixtures, including clover and other legumes with various grasses. Many such pasture mixtures have been quite complex, and such studies have been approached both from the grazing angle and the forage yield.

The initial rapid growth of ryegrass was observed by Davies and Thomas (4) when working with pure species seedings of grasses; they noted that of the several species tested, Italian ryegrass was outstanding in its rapidity of seedling

development. Findlay (5) reported that meadow fescue was not able to compete against ryegrass the first year; he also reported that the quantity of orchard grass and timothy in both hay and pasture was increased by reducing the quantity of perennial ryegrass. In their studies of turf under airport conditions, Bell and Tedrow (2) found that creeping red fescue did not compete, even where well adapted, with perennial ryegrass. They recommend that ryegrass should be omitted from the seed mixture or used only in small quantities, so as to insure a good stand of the permanent perennial grasses desired. Van Dersal (8) also recommended that the use of perennial ryegrass in turf mixtures be discontinued. Davies (3) found that perennial ryegrass exerts a strong depressing effect on the field establishment of bulb canarygrass.

In 1898 Beal (1) observed that none of the commercial lawn seed mixtures on the market produced as fine and permanent a lawn as a few of the best grasses used separately. Lapp (6) observed, from his study of 20 lawn mixtures, that the turf quality was higher and the colonizing ability stronger when the percentage of the perennial species was larger. Morgenweck (7) states that higher seeding rates, in general, are better able to compete with a nurse grass.

Findlay (5) reported that there was no direct relationship between the weight of hay produced and the quantity of

perennial ryegrass sown. In his study of pure seeding rates, Morgenweck (7) found that low seeding rates produce the same yield as higher seeding rates - because of reduced competition.

EXPERIMENTAL PROCEDURE

Four grasses were selected and used in various combinations and at different rates of seeding. Kentucky bluegrass (*Poa pratensis*) and Chewing's fescue (*Festuca rubra*, var. *commutata*) were selected as representative of turf grass and sown with domestic ryegrass (*Lolium multiflorum* and *perenne*) and redtop (*Agrostis alba*) as nurse grasses. The seed was planted on February 28 in quartz sand cultures in ten inch clay pots. Twenty-two mixtures were used, variations being made by using combinations at rates of seeding from 10 to 40 pounds per acre. In addition to the twenty-two mixtures, each of the four grasses used was sown alone as a check. The experiment was conducted in the greenhouse at Michigan State College, East Lansing, in the winter and spring of 1946.

Each mixture, and the pure species, was replicated five times, making a total of 130 pots. (The amount of seed required for the various rates of seeding was determined by calculating the ratio of the area in a ten inch pot to an

acre.) The grasses were watered regularly and were given a complete nutrient solution once a week during the period of the experiment.

Beginning on April 16, the grasses from three pots of each mixture, and pure species, were harvested. The sand was washed from the roots and the species in each mixture were separated. Roots and tops were weighed separately, both green and after being oven-dried. The grasses in the remaining two pots of the original five were harvested in a similar manner between May 16 and May 23.

EXPERIMENTAL RESULTS

Table I shows the results, on a dry weight basis, of the harvest of the grasses from the first three pots of each mixture. This harvest extended over a three week period because of the time required to separate species within a mixture. Therefore the date of harvest must be taken into consideration when comparing weights of grasses harvested from different mixtures.

It will be noted in Figure I, that of the grasses sown alone, domestic ryegrass made the greatest growth in the slightly more than six weeks between the planting of the seed and harvest. Redtop did not make as much growth as domestic ryegrass, but it more than doubled that of Kentucky

Table I. The Yields of Tops and Roots in Grams of Dry Matter
(Average of Three Pots)

Mixture and Rate of Seeding in Pounds per Acre	Dom. Rye.	Red- top	Ky. Blue.	Chew. Fes.	Total	Date of Harvest
**Rye. - 20	25.33	15.50			25.33	Apr. 16
**Red. - 20			5.66		15.50	" 16
**Blue. - 20				9.00	5.66	" 17
**Fes. - 20					9.00	" 17
Blue. - 5, Fes. - 5			7.40	5.35	12.75	Apr. 30
" 10, " 10			6.20	6.80	13.00	" 24
Rye.-5, Red.-5, Blue.-5, Fes.-5	17.00	6.83	0.65	1.02	25.50	Apr. 19
" 10, " 10, " 10, " 10	53.00	7.80	2.25	3.82	66.87	May 5
" 10, " 10, " 5, " 5	44.30	11.50	1.23	0.85	57.88	" 5
" 5, " 5, " 10, " 10	43.80	5.00	1.08	1.74	51.62	" 6
Rye.-5, Blue.-5, Fes.-5	44.50		2.12	1.80	48.42	May 1
" 10, " 10, " 10	50.50		4.00	2.80	57.30	" 6
" 10, " 5, " 5	30.80		0.56	0.57	31.93	Apr. 22
" 5, " 10, " 10	30.80		1.90	1.90	34.60	" 26
Rye.-5, Blue.-10	46.00		8.42		54.42	May 6
" 5, Fes. -10	37.70			4.00	41.70	" 7
" 5, Blue.-20	34.00		10.20		44.20	" 8
" 5, Fes. -20	54.80			16.00	70.80	" 9
Red.-5, Blue.-5, Fes.-5		20.25	4.00	3.90	28.40	May 1
" 10, " 10, " 10		37.30	3.42	4.90	45.62	" 6
" 10, " 5, " 5		23.25	1.18	0.80	25.23	Apr. 22
" 5, " 10, " 10		9.20	4.42	4.55	18.17	" 29
Red.-5, Blue.-10		24.20	7.30		31.50	May 7
" 5, Fes. -10		32.20		9.70	41.90	" 7
" 5, Blue.-20		25.70	17.80		43.50	" 8
" 5, Fes. -20		24.80		14.50	39.30	" 9
** Rye. - Domestic Rye	Blue. - Kentucky Bluegrass				All mixtures	
Red. - Redtop	Fes. - Chewing's Fescue				planted Feb. 28	



Figure I. Growth of pure species. (April 15)

Reading left to right: Chewung's fescue, Kentucky bluegrass, redtop, domestic ryegrass. All seeded at 20 pounds per acre.

Note the coarser, heavier growth of domestic ryegrass and redtop compared to that of Chewung's fescue and Kentucky bluegrass.

bluegrass and outyielded the Chewing's fescue by a considerable amount. Thus, on the basis of pure stands alone, domestic ryegrass and redtop show very well their ability to make a quick growth.

By comparing the growth of individual grasses when sown in mixture with their growth when sown alone, it was found that domestic ryegrass inhibited the growth of all other grasses, including redtop. Redtop inhibited the growth of Kentucky bluegrass and Chewing's fescue, but not to the same extent as domestic ryegrass. Figure II illustrates the overshadowing of Kentucky bluegrass and Chewing's fescue by domestic ryegrass and redtop. Domestic ryegrass and redtop definitely dominated in mixtures in which they made up only 20 percent, by weight, of the seed planted.

Kentucky bluegrass and Chewing's fescue were about equal to each other in rate of growth; neither consistently outweighed the other in comparative mixtures or when sown alone.

At the time of planting, a count was made of the number of seeds planted for each species at the different rates of seeding. It was found that 305 redtop seeds per pot was equivalent to a rate of seeding of 5 pounds per acre. For the same rate of seeding, 106 Kentucky bluegrass, 31 Chewing's fescue, or 13 domestic ryegrass seeds were required. Increased rates of seeding increased the number of seeds for each species proportionately.



Figure II. Growth of pure species compared with mixtures. (April 15)

Reading left to right: Chewing's fescue at 20 pounds per acre; mixture of redtop at 10 pounds, Kentucky bluegrass at 5 pounds, and Chewing's fescue at 5 pounds per acre; Kentucky bluegrass at 20 pounds per acre; mixture of domestic ryegrass at 10 pounds, Kentucky bluegrass at 5 pounds, and Chewing's fescue at 5 pounds per acre.

Note that domestic ryegrass and redtop dominate in the mixtures.

A count was made later of the plants in one pot seeded with a mixture of 5 pounds of Kentucky bluegrass, 5 pounds of Chewing's fescue, and 10 pounds of domestic ryegrass per acre. There were 38 Kentucky bluegrass plants, 25 Chewing's fescue plants, and only 24 domestic ryegrass plants; yet the green weight of the Kentucky bluegrass plants was only 6.0 grams, the Chewing's fescue 5.25 grams, and the domestic ryegrass 231.5 grams. The Kentucky bluegrass and Chewing's fescue plants were small and fine.

The dry weights of the grasses harvested the eleventh week after planting, from the last two pots of each mixture, are recorded in table II as the mean weights for the two pots.

Results in the second harvest are substantially the same as those obtained in the first. The ratio in a mixture of the weights of the domestic ryegrass and redtop to the weights of the Kentucky bluegrass and Chewing's fescue remained approximately the same; domestic ryegrass and redtop still definitely dominated in mixtures in which they made up only 20 percent by weight of the seed planted; and as in the first harvest, neither Kentucky bluegrass nor Chewing's fescue consistently outweighed the other in comparative mixtures or when sown alone.

However, one difference noted in the results obtained from the two harvests was a change in the ratio of the weights of the grasses harvested from the pure seedings. Compared to

Table II. The Yields of Tops and Roots in Grams of Dry Matter
(Average of Two Pots)

Mixture and Rate of Seeding in Pounds per Acre	Dom. Rye.	Red-top	Ky. Blue	Chew. Fes.	Total	Date of Harvest
**Rye. - 20	90.20	71.20			90.20	May 16
**Red. - 20			42.50		71.20	" 16
**Blue. - 20				40.20	42.50	" 16
**Fes. - 20					40.20	" 16
Blue. - 5, Fes. - 5			27.50	10.00	37.50	May 17
" 10, " 10			21.20	22.10	43.30	" 20
Rye.-5, Red.-5, Blue.-5, Fes.-5	76.70	14.50	2.00	2.60	95.80	May 17
" 10, " 10, " 10, " 10	91.70	31.00	3.00	3.70	129.40	" 19
" 10, " 10, " 5, " 5	76.70	26.70	1.20	0.80	105.40	" 18
" 5, " 5, " 10, " 10	70.20	6.60	4.50	4.70	86.00	" 20
Rye.-5, Blue.-5, Fes.-5	80.00		2.80	2.00	84.80	May 17
" 10, " 10, " 10, " 10	108.70		2.10	2.30	113.10	" 19
" 10, " 5, " 5, " 5	90.00		1.70	1.00	92.70	" 19
" 5, " 10, " 10, " 10	78.20		7.70	6.00	91.90	" 20
Rye.-5, Blue.-10	68.50		20.20		88.70	May 21
" 5, Fes. -10	78.20			4.10	82.30	" 22
" 5, Blue.-20	63.70		23.20		86.90	" 23
" 5, Fes. -20	75.20			7.00	82.20	" 23
Red.-5, Blue.-5, Fes.-5		18.50	10.00	6.20	34.70	May 17
" 10, " 10, " 10, " 10		63.50	9.50	8.50	81.50	" 20
" 10, " 5, " 5, " 5		89.70	2.50	1.90	94.10	" 19
" 5, " 10, " 10, " 10		15.00	24.20	12.70	51.90	" 20
Red.-5, Blue.-10		19.70	29.20		48.90	May 21
" 5, Fes. -10		44.00		9.20	53.20	" 22
" 5, Blue.-20		51.00	16.50		67.50	" 23
" 5, Fes. -20		54.50		17.50	72.00	" 23
** Rye. - Domestic Ryegrass	Blue. - Kentucky Bluegrass	All mixtures				
Red. - Redtop	Fes. - Chewing's Fescue	planted Feb. 28				

the weights at the first harvest, Kentucky bluegrass made the greatest gain in weight between the time of the first and second harvest, Chewing's fescue and redtop made the next greatest gains, and domestic ryegrass made the least gain of the four grasses. The average weight of the Kentucky bluegrass tops and roots in each pot increased about eight times, the Chewing's fescue and redtop each increased about five times, and the domestic ryegrass increased slightly less than four times in weight in the month between harvests. However, the average weight of the tops and roots of the domestic ryegrass per pot at the second harvest was more than twice the weight of either the Kentucky bluegrass or Chewing's fescue, and the average weight of the redtop in each pot at the second harvest was considerably greater than that of either the Kentucky bluegrass or Chewing's fescue. Comparing gains made between harvests on the basis of grams gain per pot, domestic ryegrass made the greatest gains, followed by redtop, Kentucky bluegrass, and Chewing's fescue. The gains made by domestic ryegrass and redtop were relatively high when compared to those made by Kentucky bluegrass or Chewing's fescue.

Although the results were not entirely consistent, increasing the rate of seeding of redtop from 5 to 10 pounds per acre increased the weight of the tops and roots harvested by a considerable amount. However, increasing the rate of

seeding of domestic ryegrass from 5 to 10 pounds per acre had little effect upon the weight of the tops and roots harvested. This was true in both the first and second harvests.

Doubling the rate of seeding of Kentucky bluegrass in mixtures produced inconsistent results; in about 50 percent of the cases the weight of the tops and roots harvested was not increased, or was increased only slightly; and in the other 50 percent of the cases the weights of the tops and roots harvested was increased considerably. Doubling the rate of seeding of Chewing's fescue in mixtures consistently increased the weights of the tops and roots harvested.

In both harvests, the average weight of the tops and roots harvested from the pots seeded with a mixture consisting of 5 pounds of domestic ryegrass, 5 pounds of redtop, 5 pounds of Kentucky bluegrass, and 5 pounds of Chewing's fescue per acre was almost the same as that harvested from the pots seeded with domestic ryegrass at 20 pounds per acre.

Table II shows that sowing a mixture containing Kentucky bluegrass and Chewing's fescue at 10 pounds each produced almost the same amount of top and root growth as either grass sown alone at 20 pounds per acre.

A mixture of all four grasses sown at 10 pounds each per acre, table II, produced only about 30 percent more tops and roots than a mixture of all four grasses sown at 5 pounds each.

Increasing domestic ryegrass from 5 to 10 pounds per acre, table II, increased the total weight harvested only slightly when sown with 5 pounds of Kentucky bluegrass and 5 pounds of Chewing's fescue, or when sown with 10 pounds of Kentucky bluegrass and 10 pounds of Chewing's fescue. Increasing redtop from 5 to 10 pounds per acre when sown with either 5 pounds of Kentucky bluegrass and 5 pounds of Chewing's fescue or 10 pounds of Kentucky bluegrass and 10 pounds of Chewing's fescue increased the total weight harvested considerably.

Increasing the rate of seeding of domestic ryegrass, Kentucky bluegrass, and Chewing's fescue in a mixture from 5 to 10 pounds each increased the harvest about 37 percent. Increasing the rate of seeding of redtop, Kentucky bluegrass, and Chewing's fescue in a mixture from 5 to 10 pounds each increased the weight of the tops and roots harvested well over 100 percent.

There was some variation in the amount of roots harvested, the fescue roots making up about one-fourth of the total weight of the plant; the roots of domestic ryegrass, Kentucky bluegrass, and redtop plants being about two-sevenths the total weight of the plant.

Domestic ryegrass plants were coarse and rough during their entire period of growth. Redtop plants were fine textured during their early growth, but became coarse in a few weeks time.

DISCUSSION

The growth of Kentucky bluegrass and Chewing's fescue was definitely inhibited in this experiment when sown in mixtures with either domestic ryegrass or redtop. Several workers have heretofore noted the strong dominance of ryegrass over various turf and pasture grasses, but the literature does not report any such dominance by redtop as found in this experiment.

As the experiment was set up, domestic ryegrass or redtop did not make up less than 20 percent, by weight, of the seed in any mixture in which they were included. However, the strong dominance exhibited by 20 percent domestic ryegrass or redtop in mixtures indicated that they still would have dominated in mixtures containing only 10 percent.

Results showed that increasing, or decreasing, the rate of seeding of domestic ryegrass had little effect upon the weight of tops and roots harvested. Therefore reducing the amount of domestic ryegrass in the seed mixture, within the range of this experiment, did not reduce its dominance proportionately. The results with redtop indicate that lowering its percentage in the seed mixture would be of help in reducing its dominance.

The dominance of domestic ryegrass and redtop over Kentucky bluegrass and Chewing's fescue seems to be largely due to their more rapid initial growth. Both domestic ryegrass

and redtop were noted as having a thick, heavy growth six weeks after seeding; on the same date Kentucky bluegrass and Chewing's fescue had only light to medium growth with medium thickness. These observations were made on the pure seedings. Figure I shows the relative growth of the grasses at six weeks.

Although the ratio of the weights of domestic ryegrass and redtop to the weights of Kentucky bluegrass and Chewing's fescue was reduced for the pure seedings from the first to the second harvest, the ratio of the weights of these grasses to each other when in mixtures remained approximately the same. Thus the initial dominance of domestic ryegrass and redtop over Kentucky bluegrass and Chewing's fescue was not diminished with the passage of time, within the limits of this experiment.

The data from the two harvests indicated that the finer grasses make a slow growth in the initial period but tend to make up this difference after the seedling phase has passed. This same tendency does not seem to hold true when the turf grasses are sown in mixture with the nurse grasses.

Consequently it would seem advisable to recommend pure seedings of the one desired turf grass on areas where a fast growing nurse grass was not essential in establishing quick cover. Field trials (9) with mixtures indicate that the desired grasses do not completely dominate the mixture from

one to three years after seeding, and in some cases the coarser grasses leave bare spaces in the turf for a considerable period after their death. The final establishment of complete cover of a given turf grass was accomplished much sooner when sown as a pure species than when sown at the same or heavier rates in mixture with the quicker growing, more competitive nurse grasses. The data from the present experiment seem to agree with these observations and to point out that mixtures containing the quicker starting, more aggressive grasses have only one desirable point in their favor, namely, that of quicker ground cover. Once this quick cover is accomplished, the coarser grasses appear to be a definite detriment to the establishment of a desired turf.

When comparing the production of the four species with each other, it was noted that no relationship existed between the number of seed planted and production. For a given rate of seeding, domestic ryegrass had the smallest number of seed but the greatest production; redtop had the greatest number of seed and was second in production. Although about equal in production, Kentucky bluegrass had over three times the number of seed as Chewing's fescue per unit of weight.

The experimental results indicate that, of the four grasses, Kentucky bluegrass and Chewing's fescue could grow best together and with the least competition. Neither of

these grasses was consistently dominant over the other. Although the two grasses did not compete with each other, they did not produce any better turf or increase production when in a mixture than did either of the grasses when sown alone. Showing similar results, the mixture of the four grasses sown at 5 pounds each produced only as much as the ryegrass sown alone at 20 pounds per acre.

CONCLUSIONS

1. In pure seedings, domestic ryegrass and redtop made much greater growth than Kentucky bluegrass and Chewing's fescue. Domestic ryegrass produced the greatest growth of the four grasses.
2. In mixtures, both domestic ryegrass and redtop inhibited the growth of Kentucky bluegrass and Chewing's fescue.
3. Domestic ryegrass and redtop dominated in mixtures in which they made up only 20 percent of the weight of the seed planted.
4. The dominance of domestic ryegrass and redtop over Kentucky bluegrass and Chewing's fescue did not diminish with time.
5. Kentucky bluegrass and Chewing's fescue did not compete with each other, but neither did their production increase when in mixture together.

6. Increasing, or decreasing, the rate of seeding of domestic ryegrass had little effect upon the weight of the tops and roots harvested.
7. Increasing the rate of seeding of redtop or of Chewing's fescue increased the weight of the tops and roots harvested.
8. Doubling the rate of seeding of Kentucky bluegrass in mixtures did not consistently increase production.
9. Where quick cover is not essential, sowing a desired turf grass alone will ultimately give more satisfactory turf than will a mixture which includes the coarser, more aggressive nurse grasses.

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