

## PHOSPHORUS REMOVAL BY COOL-SEASON ANNUALS OVERSEEDED ON COMMON BERMUDAGRASS

G. W. Evers and A. D. Davidson

**Background.** Applying animal waste from poultry, swine, dairy, and beef feeding operations to pastures has many benefits. Animal waste contains other plant nutrients besides N, P, and K; it contains organic matter which improves the water and nutrient holding capacity of the soil; and it may be more economical than commercial fertilizer. A disadvantage of using animal waste is that it usually contains as much P as N. Warm-season perennial grasses only remove 1 lb P for every 4 lb N. With continued animal waste applications over time, unused P builds up in the soil that can move into streams and lakes through runoff and cause environmental problems. Cool-season annual forages were compared for their ability to remove P. They were overseeded on a common bermudagrass pasture on a dairy in Hopkins County that had a soil P level of 400 ppm. Land preparation before planting was disking to a 2 or 6 in. depth before planting.

**Research Findings.** Disking depth before planting did not affect production of the cool-season forages but the deep disking (6 in. depth) did reduce common bermudagrass production about 1000 lb DM/acre (Table 1). The most productive winter annuals were rye and annual ryegrass fertilized with 200 lb N/acre. Crimson clover and hairy vetch were the most productive legumes. Alfalfa, red clover, and annual ryegrass suppressed bermudagrass production the most because of their later maturity. Common bermudagrass plus rye, crimson clover, or hairy vetch produced the most total forage. Weed yields were the greatest on common bermudagrass that was not overseeded.

Phosphorus uptake was closely associated with forage production (Table 2). Although rye and annual ryegrass produced similar amounts of forage, annual ryegrass removed 6 lb more P because of its higher P concentration. Differences among treatments for bermudagrass P removal were small and directly related to yield. The greatest amount of total P was removed when rye, hairy vetch, crimson clover, or annual ryegrass were overseeded on common bermudagrass.

**Application.** The greatest amount of P can be removed from a bermudagrass pasture by overseeding with rye, ryegrass, hairy vetch, or crimson clover. Using crimson clover or hairy vetch would be more economical because they do not require the 200 lb N/acre that the rye and ryegrass did. Added environmental benefits of overseeding with cool-season annuals are that N mineralized during the winter is taken up and they provide some spring weed control.

Table 1. Dry matter production of cool-season annual forages overseeded on common bermudagrass growing on a high phosphorus soil.

Treatment	Cool-Season	Common Bermuda	Total Forage	Weeds	Total Biomass
	-----lb DM/acre-----				
<u>Disking</u>					
2 in. depth	3,334 a	11,579 a	14,913 a	1,059 a	15,972 a
6 in. depth	3,267 a	10,420 b	13,687 b	1,171 a	14,857 b
<u>Treatment</u>					
Rye + 200 lb N	6,716 a†	11,489 ab	18,204 a	458 cd	18,662 a
Crimson clover	4,649 b	12,230 ab	16,879 ab	308 d	17,186 ab
Hairy vetch	3,856 bc	12,648 a	16,504 ab	198 d	16,702 b
Ryegrass + 200 lb N	6,576 a	9,714 cd	16,289 b	0 d	16,289 bc
Control + 200 lb N	0 e	11,398 ab	11,398 d	3,159 a	14,557 cd
Arrowleaf clover	2,853 cd	11,056 bc	13,909 c	379 d	14,288 d
Control	0 e	11,446 ab	11,446 d	2,804 a	14,251 d
Alfalfa	2,395 d‡	9,736 cd	12,131 cd	1,566 b	13,698 d
Red clover	2,662 d‡	9,276 d	11,938 d	1,163 bc	13,101 d

†Values in a column followed by the same letter are not significantly different at 0.05 level.

‡Legume component of July harvest was lost.

Table 2. Phosphorus uptake by cool-season annuals overseeded on common bermudagrass growing on a high phosphorus soil.

Treatment	Cool-Season	Common Bermuda	Total Forage	Weeds	Total Biomass
	-----lb P/acre-----				
<u>Disking</u>					
2 in. depth	20.2 a	43.8 a	64.0 a	7.0 a	70.9 a
6 in. depth	19.9 a	38.6 b	58.5 b	7.3 a	65.8 b
<u>Treatment</u>					
Rye + 200 lb N	33.3 ab†	44.2 a	77.5 a	2.9 c	80.4 a
Hairy vetch	28.5 b	48.2 a	76.7 a	1.3 c	78.0 a
Ryegrass + 200 lb N	39.8 a	36.6 bc	76.4 a	0.0 c	76.4 a
Crimson clover	27.2 bc	45.2 a	72.4 ab	1.7 c	74.1 ab
Arrowleaf clover	21.6 cd	41.6 ab	63.2 b	2.6 c	65.8 bc
Alfalfa	14.7 d‡	37.0 bc	51.7 c	10.2 b	61.9 c
Control + 200 lb N	0.0 e	41.9 ab	41.9 c	20.0 a	61.8 c
Control	0.0 e	42.0 ab	42.0 c	17.5 a	59.5 c
Red clover	15.4 d‡	34.1 c	49.5 c	7.9 b	57.4 c

†Values in a column followed by the same letter are not significantly different at 0.05 level.

‡Legume component of July harvest was lost.