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YIELD OF SORGHUM-SUDANGRASS AND PEARL MILLET UNDER SOIL DAIRY MANURE APPLICATION

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Summary

To reduce nonpoint source pollution from open lot dairies in central Texas, dairy operators must develop and adhere to a nutrient management plan to utilize solid manure. Two sorghum-sudangrass (Sorghum bicolor L.) and three pearl millet (Pennisetam americanum (L.) Leeke) hybrids were compared for yield to four rates of solid dairy manure. Higher yields averaged among five warm-season annual hybrids resulted from greater manure rates. 'Do-Mor' sorghum-sudangrass outyielded the other hybrids. 'Dyn-Na-Mite' sorghum-sudangrass planted at 30 or 85 lb seed/acre produced similar yields at either seeding rate.

Introduction

On open lot dairies in central Texas, manure from corral surfaces is collected, stock-piled, and disposed of on cropland. Increased loading of nutrients and bacteria into tributaries of the North Bosque River have been partially attributed to runoff from cropland where improper disposal of manure occurred (TWC and TSSWCB 1988). To reduce nonpoint source (NPS) pollution and maintain compliance with the Texas Natural Resource Conservation Commission regulations, dairy operators must develop and adhere to a nutrient management plan. Plans are based on recognizing the nutrient concentration in manure and what is already present in the soil and applying manure at rates that meet realistic crop yield goals. Therefore, information on nutrient concentration in solid dairy manure and yield response of forages to nutrients in manure is needed to develop such a plan. With more emphasis placed on effective animal waste utilization, dairy operators increasingly rely on growing productive warm-season annual forages (such as sorghum-sudangrass) in central Texas to supplement their feed rations and waste utilization programs. Also, a common belief among forage producers is that high plant densities will improve yield and quality of sorghum-sudangrass. However, research has indicated that this phenomenon is not always true (Holt 1965, Sanderson et al. 1994). This demonstration compared dry matter yields of two sorghum-sudangrass and three pearl millet hybrids under four rates of solid dairy manure. Also, one sorghum-sudangrass hybrid was planted at two seeding rates to

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compare yield and evaluate response to dairy manure application.

Procedure

Solid dairy manure was applied on 7 May 1991 at rates of 0, 5, 10, and 15 ton/acre (dry-weight) on a Waurika series, fine sandy loam soil at the Texas A&M University Agricultural Research and Extension Center at Stephenville. Manure was applied to plots 40 ft wide by 280 ft long replicated twice. Solid dairy manure was applied with a flail manure spreader and disked twice into the soil. The spreader was calibrated by driving over a 4 ft 8 in. square (21.8 sq ft) sheet and weighing the manure collected on the sheet. One lb of manure collected on the 21.8 sq ft sheet is equivalent to 1 ton of wet manure per acre. Manure was sampled and frozen in a plastic container until analyzed for nutrients by the Texas Agricultural Extension Service Soil, Water, and Plant Testing Laboratory at College Station.

Dryland and irrigated 'Runner' and 'Spanish' peanuts (Arachis hypogaea) were blocked across manure rates during 1991 and 1992. Solid manure was applied again on 13 Apr. 1993 according to previously described procedures at rates of 0, 5, 10, and 15 ton/acre (dry weight) over the same previously manure treated area. The amount of nutrients from solid dairy manure rates applied during 1993 are in Table 1. Two sorghum-sudangrass hybrids (85 lb seed/acre) and three pearl millet hybrids (20 lb seed/acre) were drilled across manure rates on 21 Apr. 1993. Conlee Seed Company in Waco, TX supplied all seed. Forage plots were 20 by 40 ft and randomized in a complete block with split-plot treatments in four blocks (Gomez and Gomez, 1984). Manure rates were main plots with hybrids arranged in sub-plots. An additional sorghum-sudangrass hybrid (Dy-Na-Mite from Conlee Seed Company) was drilled across four manure rates during the same planting date at 85 and 30 lb seed/acre. Seeding rate plots were also 20 by 40 ft and randomized in a complete block with split-plot treatments in two blocks. Manure rates were main plots with seeding rates arranged in sub-plots. Forages were harvested once at boot-stage with a sickle mower (6-in. stubble height) and yield determined on an oven-dry (131°F for 72 hr) basis. Rainfall was near average or above for all months except July. All statistical procedures were accomplished with PC-SAS (SAS Institute 1988).

Results and Discussion

Dry matter yields averaged across two sorghum-sudangrass and three pearl millet hybrids increased ($P<0.001$) as rate of dairy manure applied increased up to 10 tons/acre (Fig. 1). In comparing sorghum-sudangrass hybrids, Do-Mor outyielded ($P<0.001$) 'Super-Su-22' by 344 lb dry matter/acre when averaged among manure rates (Fig 2). Both sorghum-sudangrasses produced more (P<0.001) dry matter than 'Mil-Hy-300', 'Mil-Hy-99', and 'Tifleaf-1' millets, respectively. Dry matter yields of Mil-Hy-300 and Mil-Hy-99 were similar but significantly greater than Tifleaf-1. A manure rate by hybrid interaction on dry matter yields was nonsignificant.

Dy-Na-Mite sorghum-sudangrass yields averaged across seeding rates significantly (P<0.001) responded to dairy manure application (Fig 3). Dry matter yields increased as manure rates increased up to 10 tons of manure/acre. There was no significant difference between the 10 and 15 ton/acre rates. Yields of Dy-Na-Mite were similar between the 30 and 85 lb/acre seeding rates and averaged 3835 and 3914 lb dry matter/acre, respectively, among four manure rates. No manure rate by seeding rate interaction occurred.

The 10 ton/acre manure rate produced the greatest dry matter yield of warm-season annual forages. This manure rate was considered conservative relative to the amount of manure applied in the past by dairy producers that generally range from 40 to 100 ton/acre/year on some fields. Excessive manure application could result in N losses into surface and/or ground water and maximum phosphorus soil levels. Sorghum-sudangrasses outyielded millets with Do-Mor yielding the highest dry matter. Comparisons between 30 and 85 lb/acre seeding rates showed no difference in yield of the Dyn-Na-Mite hybrid. This indicates that less seed/acre will produce the same amount of forage as compared to traditionally higher seeding rates of 60 to 100 lb/acre. Further investigations should be conducted to test effects of seeding rates on yield of warm-season annual forages.

Acknowledgements

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Table 1. Amount of nutrients applied from dairy manure rates on 13 Apr. 1993.

Manure	Nutrients (Total basis)									
rate	N	P	K	Ca	Mg	Zn	Fe	Mn	Cu	Na
dry ton/acre	....lb/acre..									
5	116	50	140	990	56	0.9	50	2.6	0.2	3.3
10	231	100	281	1980	112	1.8	100	5.3	0.4	6.6
15	347	150	421	2970	167	2.6	150	8.0	0.7	9.9

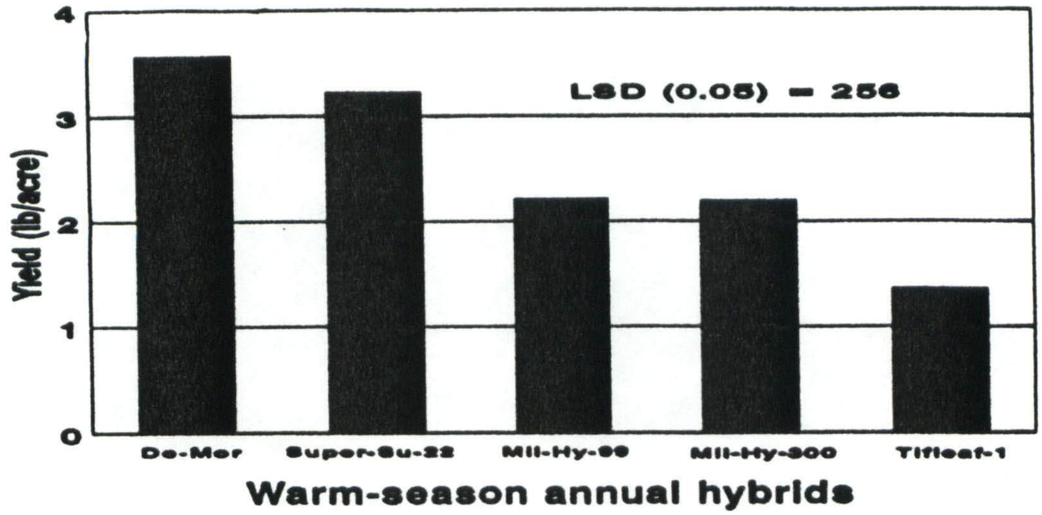

Figure 1. Yield response of warm-season annual hybrids to four dairy manure rates applied during 1993. Yield data are means of four replicates and five hybrids.

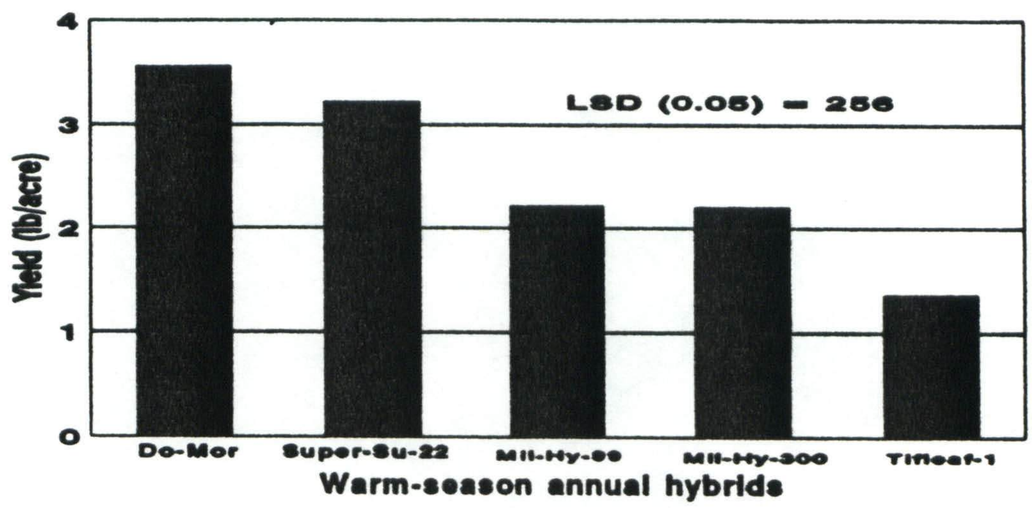

Figure 2. Dry matter yields of two sorghum-sudangrass (Do-Mor, Super-Su) and three pearl millet (Mil-Hy-99, Mill-Hy-300, Tifleaf-1) hybrids. Data are means of four replicates and four manure rates.

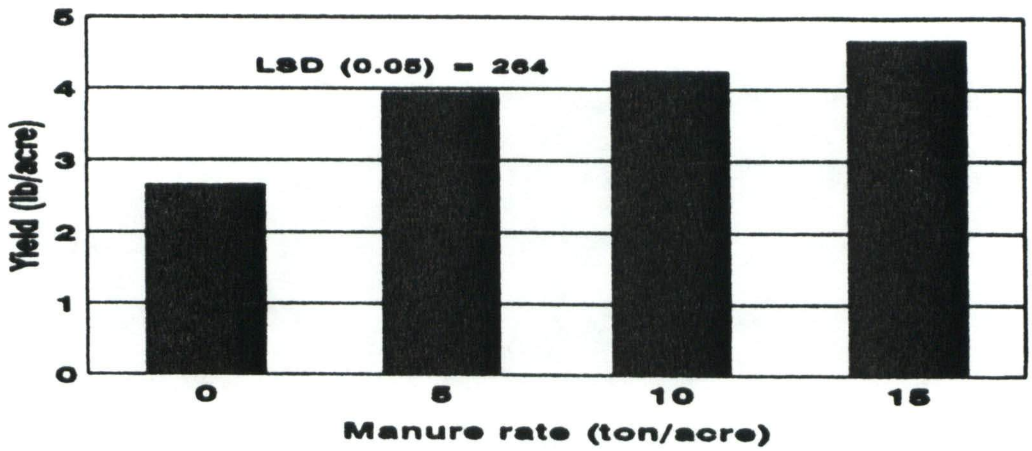

Figure 3. Dry matter yield response of Dy-Na-Mite sorghum-sudangrass to four dairy manure rates applied during 1993. Data are means of two replicates