MULTICROPPING CORN AND SORGHUM FOR SILAGE IN SOUTH FLORIDA

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Introduction

Improved perennial forage grasses can provide abundant feed from June to September, but October to May forage production is quite low. Thus the livestock carrying capacity of the pasture is limited to its cool season capability.

Dairy cattle require a continuous supply of high energy feedstuff to sustain milk production and perennial grasses can not provide these nutrients throughout the year. Consequently, Florida dairy producers must purchase shelled corn, citrus pulp or other high energy feeds to supplement grazing cattle.

However, results of multicropping studies at Ona offer encouragement with regard to South Florida's feed energy sources. Silage made from corn is a high energy feed of excellent quality (TDN 65-70%) and requires only one harvest period per year. Forage sorghum and sorghum x sudangrass hybrid silage may be considered as high energy roughage (TDN 52-60%) and requires at least 2 harvests per year. Since corn silage contains a higher percentage TDN than sorghum, less high energy feedstuffs are required for supplementation. These types of forages may help alleviate the dairymen from complete dependence on purchased feeds which may be vulnerable to drastic price changes because of disease, drought, and freeze problems.

The purpose of this multicropping corn and sorghum study was to explore the physical and economic feasibility of annually producing 2 or 3 crops in succession, on the same land. In addition, the cumulative effect of long-term continuous cropping on nematodes, insects, soil nutrients, and soil physical condition was studied. Where trade names are used no discrimination or endorsement in intended.

Methods of Procedure

Seed bed preparation

To conduct this study 34 acres of land area was cleared from the native (pine trees and saw palmettos) condition in late 1975. This flatwood soil consisted of Ona, Smyrna, and Placid fine sand. After initial land preparation, the field was tilled once annually (late January) with a mold board plow to a depth of 8 to 9 inches and disked once. Following the harvest of February seeded corn, forage sorghum was no-till seeded into the corn residue in late June.

Water control

The cultural practice of water control is a necessary element for a successful multicropping forage program in South Florida. The grower must be able to pump water off the field under periods of heavy rainfall and irrigate the crops during the dry months of March through May. Producers growing corn or sorghum on organic soils generally are able to produce a crop with little or no supplemental water. Commercial growers also have the option of delaying the spring sorghum crop from March to late May or early June. This practice would generally eliminate the use of supplemental water. However, good drainage is required on both organic and sandy soils.

To aid in drainage, a rim ditch must be constructed around the field and equipped with an automatic low lift pump to remove all excess water. In South Florida irrigation was mainly applied from March to May averaging 6.7 inches/year.

Cropping sequence

The annual crop rotation of this study was corn (seeded in February to a final population of 26,000 plants/A in 20 inch rows) followed by forage sorghum (seeded in late June at 16 lb/A in 30 inch rows) and regrowth of June planted sorghum in the fall. The spring corn crop was removed as forage in late June followed immediately by a no-till seeding of forage sorghum. The sorghum was harvested in late September to early October with the ratoon (regrowth) crop harvested in January.

Lime and fertilizer practices

A total of five tons limestone per acre was applied after the removal of the native vegetation. Fertilization practices for the corn consisted of 50-100-300 lb/A N-P_2O_5-K_2O plus 20 lb/A FTE 503(R) 1/ micronutrients initially, followed by 20 lb/A biannually of micronutrients applied at corn seeding. When corn was 8 to 10 and again 20 to 24 inches tall 100 lb/A of N was applied. The forage sorghum was fertilized when plants were 4 to 6 inches tall with 800 lb/A of 5-10-20 N-P_2O_5-K_2O fertilizer followed by an additional 75 lb/A N when plants were 12 to 15 inches tall. The ratoon crop was fertilized only with 75 lb/A N immediately after the October harvest.

Weed and insect control

The insecticide-nematicide Furadan 10 G(R) was applied at 20 lb/A formulation when corn and sorghum were seeded. This material was applied in a 7-inch band in the seed furrow prior to covering the seed. Because Furadan is a systemic, the chemical is translocated into the corn or sorghum plant protecting the plant against bud worms until plants reached a height of about 12-15 inches. The insecticide Mesurol(R) was used in a hopper box mix at a rate of 1 lb (formulation) per 100 lb seed corn as a bird repellant. The corn herbicides were Aatrex(R) plus Lasso(R) at 2 lb/A active or Aatrex(R) plus Duel(R) at 2 lb/A active. Immediately following the corn harvest in June and after the initial sorghum harvest in early

1/ FTE 503 = iron, 18%; zinc, 7.0%; manganese, 7.5%; copper, 3.0%; boron, 3.0%; molybdenum, 0.2%.

October Paraquat(R) was applied at 0.5 lb/A active to control crabgrass, pigweed and other annual seedlings in addition to temporary desiccation of common bermudagrass. No cultivation practices were employed on either the corn or sorghum.

Harvesting and ensiling practices

The corn plant was direct cut when the ear was at the dent stage of maturity. Dry matter (DM) at this physiological stage averaged 35%. The entire corn plant was harvested and stored in upright silos. This chopped forage can also be preserved well in bunker silos, of proper construction at considerable less fixed cost. Forage sorghum was whole plant harvested (28 to 35% DM) when grain was at the hard dough stage and preserved as silage. Grain yields were estimated from randomly selected hand samples for both corn and summer grown sorghum.

Results and Discussion

Forage production and quality

Dry matter percentage, yield, estimated total digestible nutrients (TDN), crude protein and other data for corn and forage sorghum are presented in Table 1. Average forage production for corn over a 5-year period was 6.5 T/A DM or 18.0 T/A green forage (as harvested) containing 37% DM at harvest. Corn grain production averaged 136 bu/A shelled @ 15.5% moisture. These dry matter yields are good when considering 20% of the field where corn and sorghum were grown consisted of low sand ponds. Corn and sorghum seeded in the sand ponds is difficult to grow because local rainfall tends to come in amounts of 1 to 4 inches over 1 to 2 day periods. Excessive moisture in the poorly drained sand pond areas results in seed germination problems in addition to irrigation problems since pond areas contain adequate moisture while well drained areas require irrigation.

Corn is a highly digestible crop as indicated by the 69% estimated TDN (digestibility) and the production of 7803 lb/A of digestible forage. However, crude protein of corn silage was rather low averaging 7.8% over 5 growing seasons.

Forage sorghum seeded in June following the corn harvest averaged 3.6 T/A DM during the summer with a digestibility and crude protein content of 52 and 4.3%, respectively. Results indicated that sorghum seeded in June and grown during the summer could produce good yields provided the crop is seeded early enough (June 21) to attain a height of 12 to 15 inches before excessive soil moisture develops. Following the initial harvest of sorghum in October, plants tillered and produced a second crop. This crop, harvested in early January averaged 0.9 T/A DM with a digestibility and crude protein of 55 and 9.7%, respectively.

Soil Organic Matter and Nutrient Status

The organic matter (OM) in this multicropping site averaged 3.7% in the native condition. After an initial drop in OM to 2.7%, it increased to a range of 4.0 to 4.5%. The native condition of the soil was quite acid (pH 4.3) containing low amounts of CaO (512 lb/A), MgO (166 lb/A), P_2O_5 (14 lb/A), and K_2O (31 lb/A). However, after following the lime and fertilization practices mentioned earlier, the soil nutrient status after 5 years of intensive cropping was CaO (1900 lb/A), MgO (185 lb/A), P_2O_5 (145 lb/A), and K_2O (110 lb/A). Dolomitic limestone should be applied at a rate of 1.0 tons/A every 3 years. This will result in an adequate soil calcium and magnesium content.

Nematode populations

Monitoring nematode populations after each crop in the drier portion of the field showed that nematodes increased as the multicropping study continued. Regardless of crop (corn or sorghum), the stubby root, spiral and lance nematodes increased in populations and persisted at high levels. Presently, soil pest problems are of utmost concern in the growth of corn and sorghum. In 1980, the fall ratoon crop of forage sorghum was reduced and 50% of the sorghum was completely eliminated. Further studies are presently being conducted to determine the exact soil pest involved, effect on yield reduction and control procedures.

In the low sand pond areas, two types of nematodes were found but did not appear to build up to high population.

Production costs

Calculating costs is a prerequisite for determining the economic feasibility of the multicropping forage program. The estimation of production costs allows the producer to develop enterprise budgets that provide a means to thoroughly evaluate the costs and return of that enterprise.

A summary of the various enterprise budgets revealed the yield, variable costs, and crop value above variable costs (Table 2). The estimated crop value is assumed to have the same value as a feedstuff that is similar in nutritional composition.

Corn forage during the 5-year period produced an average yield of 6.5 T/A DM with an average crop value above variable costs of $467.80.

Forage sorghum grown during the summer and the ratoon crop of sorghum in the fall produced an average yield of 3.6 and 0.9 T/A DM, respectively. The average crop value above variable costs was $284.79 (summer sorghum) and $46.62 (fall ratoon sorghum). Yield and quality are the two major factors affecting crop value above variable costs.

Summary

A successful multicropping system requires proper fertility, water control, proper varieties, adequate plant population, weed and insect control. In addition, timeliness of crop seeding is of utmost importance. The removal of corn and seeding of sorghum must be done within 3-4 days to allow establishment of sorghum before the rainy season. Timeliness is also important in the removal of sorghum (late September - early October) to allow adequate time for the ratoon crop to develop.

In a year around highly intensified forage program, corn can be grown successfully from February to June averaging 6.5 T/A DM, followed by forage sorghum from June to January averaging 4.5 T/A DM.

Preliminary data suggest that percent OM and several fertilizer elements can accumulate under a multicropping system when minimum tillage practices are applied.

In general, nematode populations increased with time. Infestation levels attained in this study suggest that further research is necessary to determine the importance of nematodes in the economy of crop production.

According to the costs and returns analysis, the production of corn forage, followed by a summer forage sorghum crop, was profitable. The crop value above variable costs for corn and summer sorghum was $467.80 and 284.79,respectively. This study demonstrated that 2 to 3 high energy forage crops can be produced in succession on the same land area in South Florida.

Table 1. Yield and quality of corn and sorghum grown from 3 to 5 years in a multicropping system at the ARC, Ona.

Crop	Harvest time	Forage: Dry matter at harvest	Forage Yield: Green	Forage Yield: Dry matter	Grain¶	Forage Quality: Estimated TDN		Forage Quality: Crude protein	
		%	T/A	T/A	bu/A	%	lb/A	%	lb/
Corn:†									
Forage	June	37	18.0	6.5	----	69	7803	7.8	101
Grain	June	52	----	----	136	--	----	----	--
Sorghum:†									
Forage‡	October	30	12.1	3.6	25	52	3220	4.3	31
Sorghum§	January	37	2.8	0.9	----	55	812	9.7	17

† Values represent an average of 5-years for corn and 3-years for sorghum.

‡ Initial harvest of sorghum, seeded in June following a spring corn crop.

§ Second harvest of sorghum ratoon crop.

¶ Corn grain is expressed at 15.5% moisture and sorghum grain was oven dried.

Table 2. Summary of yield and variable costs for corn and forage sorghum, ARC, Ona.

Crop	Year	Variable costs§	Yield	Variable costs	Crop value	Crop value†	Crop value above variable costs‡
		$/A	T DM/A	$/T DM	$/T DM	$/A	$/A
Corn forage	1980	312.20	6.5	48.03	120	780.00	467.80
Sorghum forage	1980	147.21	3.6	40.89	120	432.00	284.79
Sorghum ratoon	1980	61.38	0.9	68.20	120	108.00	46.62

† Crop value is assumed to have the same value as a feed stuff that is similar in nutritional composition. These values are utilized solely for the purposes of comparison and should not be interpreted as their market price.

‡ Crop value above variable costs is obtained by crop value minus variable costs.

§ Itemized list of variable cost can be obtained from ARC, Ona Research Report RC-1980-6.