USE OF SWITCHGRASS SEED AS WILD BIRD FEED

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ABSTRACT

To date, switchgrass (*Panicum virgatum* L.) seed is only used for planting new fields. However, the highly anticipated widespread planting of switchgrass as biomass for biofuel production prompted this investigation into whether switchgrass seed could be used as wild bird feed. We compared the consumption of switchgrass seed to proso millet *(Panicum miliaceum)* seed by birds from ground trays at 3 traditional bird feeding sites. We also removed the proso millet seed from the feeding sites after 21 days to determine if consumption of switchgrass seed would increase when offered independently. More ($P \leq 0.05$) proso millet seed was consumed by birds at all sites when compared to switchgrass seed. When switchgrass seed was offered independently, consumption increased significantly at only 1 site. Reasons for poor use of the switchgrass seed could be low digestibility, its small size, or other reasons such as poor taste. Future studies should evaluate whether switchgrass seed would be preferred when offered in a mixture as this sometimes increases digestibility. Seeds of other or new cultivars of switchgrass also should be evaluated.

Keywords

Switchgrass, switchgrass seed, biofuel, bird feed

INTRODUCTION

Switchgrass, a native warm-season perennial dominant of the tall grass prairie, has been identified as a highly promising source of cellulosic biomass for biofuel production in the Northern Great Plains (e.g., Lee and Boe 2005). Recent research indicated that the most sustainable biomass production system for switchgrass in eastern South Dakota was a single annual harvest after physiological maturity during early autumn (Casler and Boe 2003). Using that harvest system, biomass producers also could harvest a mature seed crop when they harvest the biomass. To date, switchgrass seed is only used for planting new fields. However, the highly anticipated widespread planting of switchgrass for biomass

prompted this investigation to determine whether switchgrass seed could be used as a source of wild bird feed.

Seed selection in granivorous birds is not well understood and varies among studies. Pulliainnen (1965), Moss (1968), and Gardarsson and Moss (1968) found some gallinaceous birds selected food based on nutritional quality while Willson (1971) and Robel et al. (1974) reported that birds will eat seeds that are most abundant. Several studies have found that handling time dictated preference for seeds by sparrows (*Emberizidae* spp.) and northern cardinals *(Cardinalis cardinalis)* (Willson 1971, Willson and Harmeson 1973, Keating et al. 1992). Handling time is determined by food characteristics (size, shape) and bird capabilities (bill size and shape) (Abbot et al. 1975, Sherry and McDade 1982). When seeds are equally abundant, granivorous birds may still not select them solely on nutritional quality or ease of handling (Shuman et al. 1990). Other factors such as seed color and flavor may also be important (Robel et al. 1997). Because of the complexity of seed selection by granivorous birds, field testing of seeds as potential bird feed is important.

The objective of our study was to determine if switchgrass seed would be readily consumed by birds at traditional bird feeding sites when offered with proso millet and independently. Proso millet was selected for comparison because it is a readily consumed component in many commercial wild bird feeds.

STUDY AREA

Our study was conducted at 3 sites within 10 km of the City of Brookings in east-central South Dakota. All 3 sites had bird feeders that were regularly filled and maintained. We used sites that had established feeding stations in order to ensure that birds would find our feeders quickly. Site 1 was located in a residential yard within the city of Brookings. The site was dominated by residential houses and roads. Large green ash *(Fraxinus pennsylvanica)* and black walnut *(Juglans nigra)* were quite prominent in this area. A tube style feeder with niger *(Guizotia abyssinica)* seed and a suet feeder were maintained here. Site 2 was 1 km north of Brookings and site 3 was 10 km east of Brookings. Both sites were private acreages with numerous buildings with open yards containing scattered trees of several species and were well protected by large shelterbelts dominated by green ash. The landscape was rolling to slightly rolling with corn *(Zea mays)* and soybean *(Glycine max)* fields dominant with wheat *(Triticum aestivum),* hay, pasture, wetlands, and Conservation Reserve Program fields also present. Site 2 had an open platform bird feeder that was regularly filled with black-oil sunflower *(Helianthus annuus)* seeds as well as tube feeders containing niger and sunflower. Site 3 had 2 existing tube feeders filled with niger seed in 1, and black-oil sunflower in the other. At Site 3 black-oil sunflower seeds also were scattered on the ground daily.

METHODS

Initially, each site was equipped with a pair of hanging tube-style bird feeders with 1 feeder containing proso millet seed and the paired feeder containing switchgrass seed. From 1-31 March 2006 both seeds were rarely eaten by birds, even when the different sized interchangeable feeding ports were changed. This method was abandoned and wooden trays (30 cm by 45 cm) were fabricated to accommodate ground feeding birds Each site was equipped with a pair of wooden trays with a 2 cm by 4 cm wooden edge around all 4 sides. Trays were placed on the ground at established bird feeding areas at sites. From 1-7 April 2006, 1 tray was filled with switchgrass seed and the paired tray was filled with proso millet seed. During this period, the trays were maintained with an abundance of food to habituate the birds to the feeding trays. From 8-28 April 2006, 200 g of each seed were placed in trays. Trays were emptied and refilled with 200 g of seed daily. The remaining seed was weighed to the nearest 0.1g and daily seed consumption was calculated. From 29 April-7 May 2006 only switchgrass seed was offered to birds to determine if consumption of switchgrass increased when it was offered independently. A Wilcoxon sign-rank test was used for analyzing consumption when both seeds were offered concurrently. The 9 days when switchgrass seed was offered independently was compared to the previous 9 days when the feeds were paired using a Kruskal-Wallis test. A significance level of $\alpha = 0.05$ was used for all analyses. JMP 5.1 (SAS Institute Inc., Cary, NC) was used for all analyses.

RESULTS

Birds removed more ($P \leq 0.05$) proso millet seed than switchgrass seed from the feeding trays when offered simultaneously (Table 1). Significantly more ($P = 0.025$) switchgrass seed was removed at site 2 when offered independently (Table 2). However, site 1 showed no difference ($P = 0.848$) and site 3 marginally significantly decreased ($P = 0.058$) in switchgrass seed consumption when the switchgrass seed was offered independently versus paired with proso millet seed.

Table 1. Mean daily seed mass ± SE removed from the feeding trays from 8-28 April 2006.

Site	Switchgrass (g)	Proso millet (g)	P	Z[a]
1	12.53 ± 2.03	109.80 ± 4.62	< 0.001	115.5
2	19.39 ± 2.90	117.16 ± 8.67	< 0.001	115.5
3	32.29 ± 8.38	168.94 ± 10.00	< 0.001	126.5

[a] Wilcoxon sign-rank test.

Table 2. Mean daily switchgrass seed mass ± SE removed from the feeding trays when offered independently or paired with proso millet.

Site	Paired (g)	Independent (g)	P	χ^2 Approximation[a], df
1	19.21 ± 3.08	21.31 ± 4.08	0.848	0.037, 1
2	10.13 ± 3.55	45.51 ± 10.99	0.025	5.000, 1
3	45.42 ± 17.77	12.49 ± 2.71	0.058	3.604, 1

[a] Kruskal-Wallis test.

DISCUSSION

Our results indicate switchgrass seed is less preferred by birds than proso millet seed although it was utilized to some degree. Even when the switchgrass was offered independently, only 1 site showed a significant increase in removal. Site 3 even showed a nearly significant decrease in switchgrass seed removal when offered independently.

We suspect nutritional quality or ease of handling caused the preference for the proso millet seed over the switchgrass seed because they were both equally available during the first part of the study. The larger size of the proso millet seed may enable birds to gather them more quickly and with less effort. Very small birds that may not be able to effectively forage on the proso millet seed may explain why the switchgrass was consumed in small amounts. Although no observational data were collected, we regularly observed small birds, such as chipping sparrows *(Spizella passerine)* and dark-eyed juncos *(Junco hyemalis),* utilizing the switchgrass seed and proso millet seed. Larger birds, such as mourning doves *(Zenaida macroura),* common grackles *(Quiscalus quiscula),* white-throated sparrows *(Zonotrichia albicollis),* and white-crowned sparrows *(Zonotrichia leucophrys),* were occasionally observed utilizing the switchgrass seed.

Although gross energy content of these 2 seeds is quite comparable, the metabolic energy efficiency of the proso millet seed is much higher. Madison and Robel (2001) found gross energy content of switchgrass and proso millet to be 4,506 and 4,417 cal/g respectively. These results were similar to those of Willson (1971), Shuman et al. (1988), and Saunders and Parrish (1987). Metabolic energy efficiency for proso millet seed ranges from 83.7% in mourning doves *(Zenaida macroura)* (Shuman et al. 1988) to 79.8% in northern bobwhites *(Colinus virginianus)* (Madison and Robel 2001). Saunders and Parish (1987) reported a metabolic energy efficiency of 61.7% for switchgrass seed in scaled quail *(Callipepla squamata)* and Heffron and Parrish (2005) found greater prairie-chickens *(Tympanuchus cupido)* only utilized 42.0% of the available energy in switchgrass seed. When northern bobwhites were fed only switchgrass seed or proso millet seed in a laboratory setting those fed switchgrass lost 7.0% of their body weight while body weights of those fed proso millet seed remained nearly unchanged (Madison and Robel 2001). These same birds ate less switchgrass seed per day than proso millet seed when they were offered in excess. In a similar study, scaled quail consumed less switchgrass seed when compared to 11 other seed species and also lost significant body weight (Saunders and Parrish 1987).

Due to its low preference and low digestibility by birds, switchgrass seed may not be effective bird feed. Future studies should explore whether certain species of birds show a preference for switchgrass seed. There may be some small-billed birds that prefer the small size of switchgrass seed because their bill size limits the size of seed they can consume. Yet, the low digestibility of this seed may still limit its benefits to birds even if it is readily consumed.

Future studies should also investigate the use of switchgrass seed in a mixture of other seeds. Multiple studies (Madison and Robel 2001, Saunders and Parrish 1987) have found substantial increases in metabolic energy efficiencies of seeds when birds consume them in a mixture rather than alone. Additionally, the low metabolic efficiency may be due to an energetic dilution effect of the higher proportion of seed coat to seed contents. Large genetic differences occur among populations of switchgrass for seed size (Boe 2007), and heritability for seed size is high in large-seeded populations of switchgrass (Boe 2003). Therefore, agronomic breeding for increased seed size also is of consideration.

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