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Waterfowl foods in managed grain sorghum fields in the Mississippi Alluvial Valley

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Extended Abstract: Grain sorghum (hereafter sorghum) is a grain crop commonly grown in the southern United States. Following harvest, sorghum can regenerate from roots or stalks and produce a second seed head (i.e., ratoon). Ratoon crops in the Mississippi Alluvial Valley (MAV) are generally insufficient to justify harvest. Unharvested ratoon sorghum, waste sorghum grain (i.e., grain lost before or during harvest), and seeds of natural plants (e.g., moist-soil plants) growing in sorghum fields can provide food for wintering waterfowl. Sorghum has a true metabolizable energy (TME) of 3.5 kcal/g (dry mass) for ducks compared to 3.6 kcal/g for corn. Moist-soil seeds have an average TME of 2.5 kcal/g.

Researchers have reported declines in availability of waste rice, soybean, corn, and sorghum for wintering waterfowl in the MAV (Stafford et al. 2006, Foster 2009). Therefore, habitat management providing supplemental food for wintering ducks is warranted. Accordingly, our objectives were to estimate and compare abundances of ratoon sorghum, waste grain, and natural seeds among experimental post-harvest treatments of mowing, crushing, or no manipulation (control) of stubble and soil fertilization or not in fields within the MAV.

We used a split-plot randomized block design with 1 block in each of a total of 22 fields in Arkansas ($n = 8$), Mississippi ($n = 2$), and Louisiana ($n = 12$) in 2006 and 2007. We randomly assigned and applied mow, crush, or no treatments of sorghum stubble to each plot (0.8 ha), 1-10 days after harvest. Additionally, we randomly assigned a fertilization treatment (~168 kg/ha of prilled ammonium nitrate) or none to each half plot (0.4 ha) and applied fertilizer immediately after application of experimental treatments. We collected data after maturation of ratoon crops or the first killing frost (3 November – 11 November 2006, 2 November – 12 December 2007). We collected 10 ratoon samples from each plot by hand clipping sorghum heads. We also collected 10 waste grain and 10 natural seed samples from each plot using established techniques (Ripley and Perkins 1965, Penny et al. 2006).

We analyzed data using SAS PROC MIXED with treatment, fertilizer, and year as fixed effects and site and block as random effects. We tested for main effects and interactions and removed non-significant interactions from the model. We conducted all significance tests at $\alpha = 0.05$.

We detected a significant fertilizer by year interaction on mean abundance of ratoon sorghum ($F_{1, 109} = 10.99$, $P = 0.001$; Table 1). However, we did not detect a treatment effect on mean abundance of ratoon sorghum ($F_{2, 109} = 0.31$, $P = 0.732$).

Marked differences in rainfall occurred between growing seasons 2006 and 2007. Our study sites were in Arkansas, Mississippi, and Louisiana

counties that were declared moderately to extremely dry from March – August 2006 by the National Climatic Data Center of the National Oceanic Atmospheric Administration. These same counties were considered mid-range in rainfall received by May 2007 and abnormally moist from June – November 2007. Plant stress from drought affects nutrient uptake, slows growth, and reduces grain production. Lack of rainfall likely affected ability of sorghum to uptake fertilizer and produce a ratoon crop in the drought of 2006.

Table 1. Mean dry mass (kg/ha) of ratoon grain sorghum in Mississippi, Arkansas, and Louisiana in 2006 and 2007.

Year	Treatment	*n*	$\bar{x}$ [a]	SE
2006	Fertilizer	18	15.3 A	6.20
	None	18	29.1 A	12.71
2007	Fertilizer	45	219.5 B	39.65
	None	45	53.2 A	11.43

[a] Means within the column with unlike letters differ ($P \leq 0.05$).

We did not detect a treatment effect ($F_{2, 35} = 1.17$, $P = 0.322$) on mean abundance of waste grain ($\bar{x} = 109.84 \pm$ [SE] 36.50 kg/ha). We did not test the effect of fertilizer on waste grain because its abundance was related to combine and harvest operations and not fertilization.

We neither detected a treatment ($F_{2, 107} = 0.04$, $P = 0.96$) nor fertilizer effect ($F_{1, 107} = 1.98$, $P = 0.163$) on mean abundance ($\bar{x} = 16.16 \pm 2.14$) of natural seeds in our plots. Our sorghum fields were in a 2–4 year crop rotation with rice or soybean. Regular crop rotation with glyphosate-resistant rice and soybean may decrease grass and weed abundance and explain partly our inability to detect differences.

A sorghum field in which stubble is not treated post-harvest, but the field is fertilized as in our study, and ambient conditions are similar to those during 2007 may produce 3,582 duck-existence days (DEDs)/ha from ratoon sorghum, waste grain, and natural seeds. This estimate compares with 4,454 DEDs/ha in managed moist-soil wetlands (Kross et al. 2008).

Due to fuel and other costs associated with applying mechanical treatments and no detection of treatment effects, we recommend leaving stubble standing after harvest to produce ratoon crop for wintering waterfowl in the MAV. If average or wet soil conditions exist post-harvest and plants are under minimum stress from the growing season, we recommend application of fertilizer to increase ratoon yield. Additionally, managers may leave a portion of the crop not harvested to deter seed depletion during winter (Foster 2009).

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