CENTRAL ARKANSAS REFUGE COMPLEX
Seed Yield and Duck-energy Day Estimates
October 2009

Summary

Richard Crossett submitted un-pressed seed heads collected from 25 plots in two moist-soil impoundments (WF-009 and WF-017) located on the USFWS Central Arkansas Refuge Complex to the University of Tennessee Wetlands Program for seed prediction and duck-energy day (DED) estimates. Seed heads were received on 29 October 2009, they were pressed for 1.5 months, seed-head area for each sample was scanned, and area (cm^2) estimates were used to predict seed production (g) per plant using models in Gray et al. (2009). Seed production/plant was multiplied by plant density/m^2 for each species, seed production was summed across species, and estimates were converted to kg/ha and lbs/ac. Duck-energy day estimates were calculated using seed production, true metabolizable energy of seed, and the daily energy requirement of mallards (Reinecke et al. 1989). See http://fwf.ag.utk.edu/mgray/DED/DED.htm for more details on methods. Seed production and DED estimates were averaged among plots for each impoundment, and the standard deviation and 95% confidence intervals were calculated.

Seed production for WF-009 ranged from 76 – 1605 kg/ha (68 – 1432 lbs/ac) among plots (Table 1). Average seed production was 530 kg/ha (474 lbs/ac, Table 2), and could be classified at the high-end of moderate seed yield (see below). This impoundment is in early succession, but soil disturbance is recommended in 2010. Seed production for WF-017 ranged from 0 – 71 kg/ha (0 – 63 lbs/ac) among plots (Table 1). Average seed production was 19 kg/ha (17 lbs/ac, Table 2), and could be classified as low seed production (see below). This impoundment is in late succession or an environmental condition (e.g., nuisance plants) is limiting seed production. Soil disturbance or herbicide application is recommended in 2010. Duck-energy day estimates are provided for both impoundments (Table 2).

Seed Production Reference Values[1]

- <200 kg/ha = low production
- 200-600 kg/ha = moderate production
- >600 kg/ha = high production

[1]Based on moist-soil production estimates provided in Gray et al. (1999) and Kross et al. (2008).

Literature Cited

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Table 1. Estimates of seed production[1] and duck-energy days (DED)[2] for two moist-soil impoundments in the Central Arkansas Refuge Complex, October 2009.

Impoundment	Plot	kg/ha	DED/ha	lbs/ac	DED/ac
WF009	1	809.46	7623.30	722.09	6800.45
	2	454.39	4276.80	405.34	3815.17
	3	652.44	6258.57	582.02	5583.02
	4	152.97	1376.49	136.46	1227.91
	5	257.78	2427.70	229.96	2165.66
	6	642.64	6014.59	573.27	5365.38
	7	1605.09	15356.23	1431.84	13698.69
	8	386.22	3618.79	344.53	3228.18
	9	190.41	1790.42	169.86	1597.16
	10	75.68	712.80	67.51	635.86
	11	149.90	1410.18	133.72	1257.97
	12	586.04	5519.18	522.78	4923.44
	13	668.95	6275.18	596.74	5597.84
	14	786.65	7380.79	701.74	6584.11
	15	543.75	5119.86	485.06	4567.23
WF017	1	6.62	56.02	5.91	49.97
	2	13.38	123.18	11.94	109.88
	3	61.65	580.58	55.00	517.91
	4	2.06	19.42	1.84	17.32
	5	70.69	597.78	63.06	533.26
	6	9.25	82.66	8.25	73.74
	7	7.58	71.06	6.76	63.39
	8	0	0	0	0
	9	8.4	96.1	7.49	85.73
	10	7.3	83.5	6.51	74.49

[1]Estimates predicted from scanned seed-head area of moist-soil plants using models in Gray et al. (2009).

[2]Duck-energy days quantified by multiplying seed production by true metabolizable energy of seed and dividing by the daily energy requirement of mallards (Reinecke et al. 1989).

Table 2. Descriptive statistics for seed production[1] and duck-energy days (DED)[2] for two moist-soil impoundments in the Central Arkansas Refuge Complex, October 2009.

				95% Confidence Interval	
Impoundment	Variable	$\bar{x}$ [3,4]	SD	Lower	Upper
WF-009	lbs/ac	473.5	342.1	284	663
	DED/ac	4469.9	3269.6	2659.3	6280.5
	kg/ha	530.8	383.5	318.5	743.2
	DED/ha	5010.7	3665.2	2981	7040.4
WF-017	lbs/ac	16.68	22.6	0.48	32.8
	DED/ac	152.6	199.2	10.1	295.1
	kg/ha	18.7	25.4	0.54	36.8
	DED/ha	171	223	11.3	330.8

[1]Estimates predicted from scanned seed-head area of moist-soil plants using models in Gray et al. (2009).

[2]Duck-energy days quantified by multiplying seed production by true metabolizable energy of seed and dividing by the daily energy requirement of mallards (Reinecke et al. 1989).

[3]n = 15 and 10 plots (1-m^2) for WF-009 and WF-017, respectively.

[4]Total DEDs for WF-009 (90 acres) = 402,291 and for WF-017 (141 acres) = 21,517, which is equivalent to having the capability of energetically supporting 4470 and 239 ducks per day, respectively, for 90 days.

CENTRAL ARKANSAS REFUGE COMPLEX
Regression Analysis
Rice Model

Summary

Richard Crossett submitted 68 un-pressed rice seed heads collected from five moist-soil impoundments located on the USFWS Central Arkansas Refuge Complex to the University of Tennessee Wetlands Program for development of a new model for predicting seed production of rice plants. Seed heads were received on 29 October 2009; 6 plants were unusable due to mold thus 62 plants were used for model development. Seed heads were pressed for 1.5 months and seed-head area (cm^2) for each sample was scanned. Seeds were threshed from inflorescences, chaff removed, and samples oven dried at 50º C for 24 hours. Dry seed was weighed to the nearest 0.001 g for an estimate of seed production per plant. If there was >1 seed head per plant, seed mass was summed across seed heads. Simple linear regression was used to relate seed mass to seed-head area, and build the prediction model for rice. Normal (R^2) and predicted (R^2_{pred}) coefficients of determination were calculated as measures of model precision and predictive ability, respectively.

The rice model explained significant variation (R^2 = 87%, $F_{1,60}$ = 389.6, $P < 0.001$) in seed production per plant and had high predictive ability (R^2_{pred} = 85%, Figure 1). The final model is: $mass(g) = -0.802 + 0.103(scanned\ seed\ head\ area\ in\ cm^2)$.

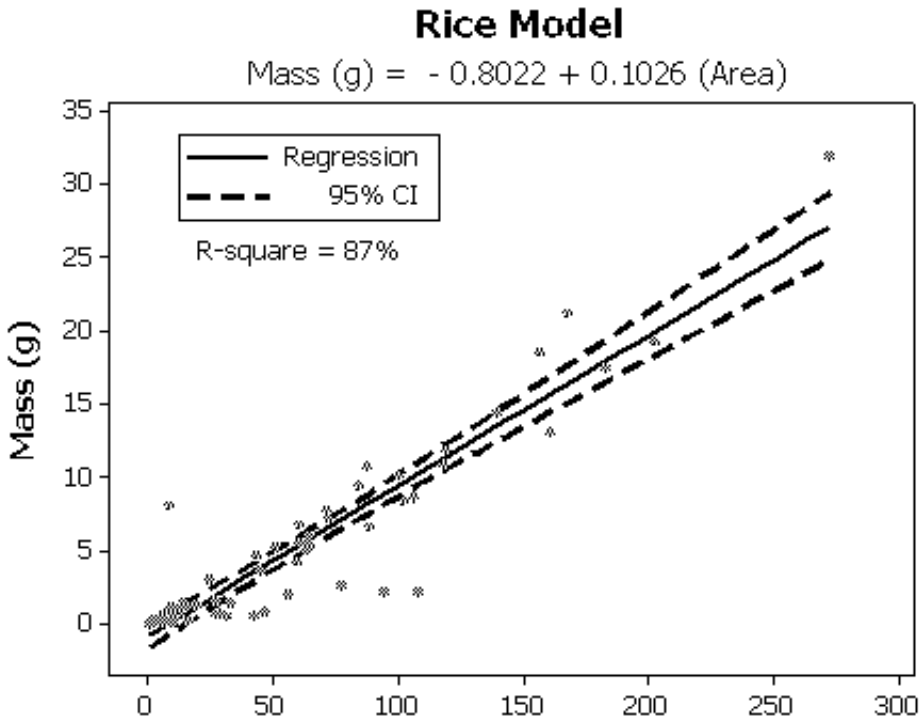

Figure 1. Regression of seed production (g) and scanned seed-head area (cm^2) per plant for rice, Central Arkansas Refuge Complex, October 2009.