LOSS OF WATERFOWL FOODS IN RICEFIELDS IN SOUTHWEST LOUISIANA[1]

LARRY R. MCGINN[2]
AND
LESLIE L. GLASGOW

Presented at the 17th Annual Meeting
Southeastern Association of Game and Fish Commissioners
Hot Springs, Arkansas, October, 1963

Recent studies indicate that the ricelands of southwest Louisiana have a high potential for development as excellent wintering habitat for waterfowl. Almost a half million acres of rice are grown in Louisiana each year and approximately twice as many acres remain fallow because of rotational practices in rice culture.

Waterfowl food availability studies of cultivated and fallow ricefields in Louisiana by Harmon (1960), Rumsey (1961) and Davis (1961) have revealed the presence of preferred waterfowl foods. These studies showed a drastic decrease in the amount of food present from November to February. Passerine birds, waterfowl, rodents, domestic livestock, insects, seed germination and seed deterioration were suspected as being responsible for the seed reduction.

The importance to waterfowl of rice and seeds of plants associated with rice culture in the Gulf Coastal areas has been demonstrated in several food habit studies. Among the important waterfowl food producing plants, other than domestic rice (*Oryza sativa*), found in cultivated and fallow ricefields of Louisiana were: red rice (*Oryza sativa* var.), signalgrass (*Brachiaria platyphylla*), junglerice (*Echinochloa colonum*), barnyardgrass (*Echinochloa crusgalli*), brownseed paspalum (*Paspalum plicatulum*), swamp smartweed (*Polygonum hydropiperoides*), pink smartweed (*Polygonum pennsylvanicum*), and stout smartweed (*Polygonum densiflorum*). Because of their importance, seeds of these plants were tested for deterioration and loss in this study. Browntop-millet (*Panicum ramosum*), a favorite cultivated wildlife food plant, was also tested because of its potential value in waterfowl food plantings.

Although presently used by waterfowl, proper development and management of ricefields would provide many additional acres of good wintering habitat, especially for grain-feeding ducks and geese. A knowledge and understanding of the problems responsible for the reduction in quantity and quality of seeds in ricefields would permit the waterfowl manager to take steps to reduce the losses, conserve the food and apply sound management for the benefit of the hunter, landowner and waterfowl.

The objectives of this study were to determine for two conditions of exposure: (1) the rate and magnitude of the loss of ricefield seeds commonly eaten by waterfowl in southwest Louisiana, (2) the causes responsible for the loss, and (3) the effect on viability and nutritional content of the seed. To meet these objectives, seeds were exposed on the ground surface and submerged in a flooded condition similar to that used in rice production.

STUDY AREA

The principal study area was located at the Louisiana State University Rice Experiment Station, Crowley, Louisiana. Its soils, topography, climate and vegetation are typical of the major rice-growing area of southwest Louisiana. Originally, the ricelands were covered by tall prairie grasses, but the land is now used almost exclusively for rice production and pasture. The general cropping system is rice production one year and pasture two years or more. Much of the land remains

---

[1] A contribution from the Louisiana State University School of Forestry and Wildlife Management and the Louisiana Cooperative Wildlife Research Unit. The writers are indebted to Dr. H. R. Caffey and personnel of the L.S.U. Rice Experiment Station, Crowley, La., for providing facilities and technical assistance.

[2] Present address: Tennessee Game and Fish Commission, 129 Stratton Blvd., Ashland City, Tennessee.

fallow between rice crops and when not planted to improved pasture, reverts to weeds and grasses.

Methods and Materials

Approximately two quarts of mature seed of each plant species were collected by hand. They were cleaned in a mechanical seed blower which removed immature seeds, light chaff, and grit. Only mature, sound seeds were used in the exposure tests.

Seed samples were exposed for 30, 60, 90, and 120 days. Exposure was begun in mid-September and was terminated in mid-February.

Four types of tests were made to measure the deterioration or loss and to determine the causes for the loss of seeds. They were: (1) actual field loss; determined by computing the actual number of seed that disappeared during exposure, (2) deterioration; determined by calculating the percentage of sound seed remaining after exposure, (3) loss in viability; determined by comparing the per cent of germination of unexposed seed with the per cent of germination of exposed seed, and (4) nutritional loss; determined by comparing the nutritional value of unexposed seed with the value of exposed seed.

An equal number or quantity of seed was used for each exposure condition but sample sizes varied for the different tests. Samples containing 100 seeds each were used in determining actual field loss. Gram-weight samples were used in the deterioration and viability tests. Because of size differences in seed, 20-gram samples of domestic and red rice were used while only 5-gram samples of other seeds were tested. A 50-gram sample was used in the nutritional value studies. Three replications were made for each test with the exception of one for nutritional analysis.

Realizing that the exact environment of a seed lying exposed in a ricefield could not be duplicated, trays were designed and placed in the field to approximate natural exposure conditions. Trays were made of galvanized 1 x 2 inch mesh welded wire measuring 12 inches square by two inches deep. Two types of tray liners were used to hold the seed samples during exposure and to aid in seed recovery: (1) Galvanized screen liners (16-mesh per inch). These liners, which were of the same dimensions as the trays, fit securely inside the tray, (2) Plastic screen liners (16-mesh per inch). These liners were made by folding a piece of screen 12 inches wide by 24 inches long and securing the sides and end with an office stapler. This formed a fine-meshed bag that fit inside the welded wire tray. In general, galvanized liners were used for seed exposure on the ground and plastic liners for exposure in water.

In an attempt to duplicate natural conditions, approximately one inch of screened ricefield soil was placed in each tray having a galvanized screen liner. The soil was pulverized and screened to remove all seeds and foreign matter. Each tray was inserted in the ground so that the top of the soil in it was on the same level as the ground surface.

Seeds were tested under two conditions normally associated with rice production. They were: (1) submerged in four to six inches of water, and (2) exposed on the ground surface. An impoundment 24 feet wide by 36 feet long was constructed beside a canal to facilitate flooding. Adjacent to the impoundment an area of similar size was cleared of all vegetation for ground exposure tests. A wooden frame with a wire covering was constructed on the ground-exposure area to protect seed from passerine birds, waterfowl and large mammals. This frame protected all samples except those used to measure actual field loss.

The three trays representing actual field loss contained 100 seeds each at the beginning of exposure. The seeds were recovered from the soil by washing the tray contents through a set of graduated screens. Final separation was by hand with the aid of a series of graduated sieves, forceps, and a fluorescent lighted magnifier. Field loss was determined by subtracting the number of seeds recovered from the number of seeds planted.

As the samples for testing seed deterioration were removed from the field, the material was screened to separate the seeds from the soil. Three hundred seeds were selected at random from the recovery group and divided into three units of 100 seeds each. Each unit represented one measurement. An average of the three samples was used as an indication of how much deterioration occurred. Deterioration was determined by examining each seed, either by: (1) a thumbnail test or by (2) cutting the seed with a sharp instrument. Rate of deterioration of seeds was determined by comparing deterioration percentages for the different exposure periods.

Seeds were recovered for viability tests in the same manner as previously described. Germination tests were initiated as soon as possible after the exposed seeds were recovered. From the recovery group, 300 seeds were chosen at random. These seeds were divided into three units of 100 seeds each and uniformly placed in separate petri dishes on moist, non-toxic germination paper. Each sample was tested for a 30-day period. Seeds that did not germinate during the 30-day period were checked for soundness. This gave some indication of what per cent might germinate at a later date if conditions were favorable.

Unexposed seeds were checked for germination by the same procedure. These tests were delayed until the first spring following collection to allow time for seeds to overcome dormancy.

Seed samples for determining nutritional loss were exposed in plastic screen bags. The accumulation of soil and sediment deposited on the sample during exposure was removed by washing with water. After air drying, the seeds were removed from the liners, and sent to the laboratory for chemical analysis. Analyses were completed by chemists of the Feed and Fertilizer Laboratory at Louisiana State University as recommended in *Official Methods of Analysis,* Association of Agricultural Chemists (1955). All chemical analyses were converted to a moisture-free basis to facilitate comparison of samples.

Results and Discussion

Actual Field Loss

The results obtained from chi-square tests and percentage of seed loss for each plant species are presented in Table 1. After 120 days of

Table 1. Per Cent Loss of Seeds When Exposed on the Ground Surface and When Submerged in Water.

		Length of Exposure (Days)			
Species	Exposure Condition	30	60	90	120
		Per Cent			
Domestic rice	Ground surface	17[1]	20	8	6
	Water	3	8	3	0
Red rice	Ground surface	5	7	83[2]	78[2]
	Water	0	2	4	9
Signalgrass	Ground surface	37[2]	0[1]	40[2]	17
	Water	8	13	6	14
Junglerice	Ground surface	89[2]	56[2]	68[2]	65[2]
	Water	13	14	22	5
Barnyard millet	Ground surface	53[2]	53[2]	90[2]	94[2]
	Water	3	7	10	8
Browntopmillet	Ground surface	33	21	73[2]	95[2]
	Water	33	15	1	7
Brownseed paspalum	Ground surface	49[2]	65[2]	66[2]	61[2]
	Water	13	9	4	1
Swamp smartweed	Ground surface	8	38[2]	35[2]	72[2]
	Water	10	15	16	18
Pink smartweed	Ground surface	2	22[2]	44[2]	53[2]
	Water	16[2]	6	5	19
Stout smartweed	Ground surface	8	25	63[2]	69[2]
	Water	27[2]	32	22	37

[1] Significantly different at the 5% level.
[2] Significantly different at the 1% level.

exposure, with the exception of domestic rice and signal grass, all seeds showed a greater loss when exposed on the ground than when exposed in water. Junglerice, barnyardgrass and brownseed paspalum suffered high losses during the early stages of the ground-exposure trials. All tests showed that seed loss occurs much more rapidly on the ground surface than when seeds are under water.

Seeds of plants are dispersed readily by natural means such as mammals, birds, insects, wind and water. Each could influence the gain or loss of seeds of the exposed samples.

Stoddard in 1931 reported that small rodents, cotton rats (*Sigmondon hispidus*) specifically, feed heavily on game bird foods. White footed mice (*Peromyscus*), harvest mice (*Reithrodontomys*), house mice (*Mus musculus*) and cotton rats are known to be serious field pests of grain crops. A close inspection of damaged seeds in the exposure trays revealed the presence of small rodents and other small mammals. To determine what small rodents were present, 60 traps were set on four different nights. The total catch included seven cotton rats, three harvest mice, and one white footed mouse, all of which are known to eat seed. Because of the type of damage inflicted on the seeds and because of the presence of these small rodents, it is concluded that they were responsible for part of the loss.

Many birds associated with agriculture were seen during each visit to the study area. An intensive study by Neff and Meanly (1957) on blackbird relationship to rice in Arkansas revealed high utilization of rice and wild grasses by blackbirds. During visits to the exposure area 32 birds were collected for stomach examination. An intensive study of birds associated with rice culture was not possible during this study, but the limited amount of material collected gave some indication of the food habits of birds of the general area. Birds collected were: seven cow birds *(Molothrus ater)*, six red-winged blackbirds *(Agelaius phoeniceus)*, four English sparrows *(Passer domesticus)*, four starlings *(Sturnus vulgaris)*, two killdeer *(Charadrius vociferus)*, one bronzed grackle *(Quiscalus quiscula)*, and one dowitcher *(Limnodromus griseus)*. Domestic rice was present in 40.6 per cent of the crops, with the percentage of occurrence of the other plant seeds tested in this study as follows: millets 34.0, smartweeds 18.5, red rice 3.2, signalgrass 3.2, and brownseed paspalum 0. Therefore it is likely that birds were responsible for part of the loss.

The climate in much of the rice producing area is highly favorable to insect pests of rice, grass and weed seeds. Insects were not noted to cause serious seed damage during this study, however, they may be a factor in causing losses to exposed seeds.

Climatic factors may result in the loss of some seed. The remains of deteriorated seed could be carried away easily by a light breeze and even fairly heavy seed by a strong wind. Heavy rains that caused temporary flooding may have washed some seeds away. These same factors could just as easily add seeds to the test plots providing the proper seed source were available.

Deterioration

Data from three samples of seed were used to compute deterioration. The results are shown in Table 2, along with the results of the chi-square tests which were used to determine the significance between exposure conditions. One hundred seeds were selected at random from each of three samples. Each seed was dissected and examined. A seed was considered to have deteriorated if: (1) internal examination showed substantial loss of embryo or endosperm, (2) seed coat was empty, (3) part of the seed was missing, or (4) there was noticeable destruction by mammal, bird or insect.

During the 30-day exposure period, red rice, signalgrass, junglerice, barnyardgrass, browntopmillett and pink smartweed showed little deterioration. Rapid deterioration occurred during underwater exposure of domestic rice, brownseed paspalum, swamp smartweed and stout smartweed with percentages of 94.3, 60.7. 45.7, 63.3, respectively. These rates remained relatively stable throughout the remaining exposure time.

As exposure progressed into the winter months, deterioration of ground-exposed seeds showed a substantial increase. After 120 days exposure on the ground, all seed samples exceeded 60 per cent deterioration and rates obtained for domestic rice, red rice, signalgrass, junglerice, brownseed paspalum and swamp smartweed ranged over 90 per cent. After an exposure of 120 days under water, red rice, signalgrass, junglerice, and barnyardgrass had deterioration percentages of 0.3, 1.0, 6.7, and 6.3, respectively.

After 120 days, a significantly higher deterioration rate was obtained for exposure on the ground surface of red rice, signalgrass, junglerice, barnyardgrass, browntopmillet, brownseed paspalum, and swamp smartweed than when submerged under water. In general, all species, except domestic rice, deteriorated less from exposure in water than from exposure on the ground (Table 2).

Damage by rodents and sprouting of seed during exposure were the major factors causing high loss of seed. The seed samples that were exposed on the ground showed signs of heavy feeding by rodents or other small mammals. Approximately 80 per cent of the seed of domestic rice, red rice, signalgrass, and the millets, when recovered after the longer periods of exposure, were represented by empty florets. To verify that the empty seeds were a result of feeding rodents, a controlled experiment was conducted, allowing mice to feed freely on the same kind of seeds. Comparison of the field-exposed seeds with the controlled-experiment seeds indicated enough similarity to conclude that destruction of many of the field-exposed seeds was caused by small rodents.

The sprouting of the seeds during exposure resulted in their deterioration. Although waterfowl readily eat sprouted seed, all germinated seed were considered to have deteriorated. Conditions after rice harvest in August and September are generally favorable for germination of waste grain, grass and weed seeds. Domestic rice exhibited no dormancy

Table 2. Per Cent Deterioration of Seed When Exposed on the Ground Surface and When Submerged in Water.

Species	Exposure Condition	Length of Exposure (Days) 0	30	60	90	120
		Per Cent				
Domestic rice	Ground surface	0.0	1.3	69.6	80.3	100.0
	Flooded	0.0	94.3[1]	98.3[1]	99.7[1]	99.0
Red rice	Ground surface	0.0	1.3	70.0[1]	81.3[1]	93.0[1]
	Flooded	0.0	0.7	0.7	0.3	1.0
Signalgrass	Ground surface	1.3	0.3	9.5	44.0[1]	99.0[1]
	Flooded	1.3	3.7	2.0	2.3	1.0
Junglerice	Ground surface	2.0	1.3	14.0[1]	62.3[1]	95.3[1]
	Flooded	2.0	3.0	0.7	4.0	6.7
Barnyardgrass	Ground surface	4.3	8.3	49.7[1]	78.0[1]	85.7[1]
	Flooded	4.3	8.0	6.7	9.0	6.3
Browntopmillet	Ground surface	1.3	0.7	69.7[1]	85.7[1]	95.0[1]
	Flooded	1.3	8.0	15.0	25.0	26.3
Brownseed paspalum	Ground surface	9.7	23.3	30.7	21.3	80.7[1]
	Flooded	9.7	60.7[1]	47.3	43.3[2]	38.3
Swamp smartweed	Ground surface	11.7	15.0	59.0	69.0	91.3[1]
	Flooded	11.7	45.7[1]	66.3	61.7	57.7
Pink smartweed	Ground surface	4.7	4.3	37.7	55.3	61.3
	Flooded	4.7	11.3	56.0	47.3	50.7
Stout smartweed	Ground surface	26.7	42.3	75.0	59.7	76.7
	Flooded	26.7	63.3[2]	66.7	70.2	72.3

[1] Significant at the 1% level.
[2] Significant at the 5% level.

period after harvest when exposed on moist soil and readily germinated during the early stages of exposure. All plant seeds showed some sign of sprouting during exposure, but it was not pronounced until conditions were again favorable during mid-February. However, by mid-February all plant species except the smartweeds had been removed from the exposure area. Only the smartweeds were affected by early spring germination. All species other than domestic rice, apparently retained their dormancy during exposure from September through January. Mild weather and alternate wet and dry conditions which prevailed probably encouraged seed deterioration by fungi and bacteria. Rice authorities indicate that fungi and other soil organisms damage rice when it is first sown; therefore, nearly all seed rice is treated with a fungicide.

Seed Viability

Seed viability was determined by germination tests. Results of these tests are shown in Table 3. Chi-square tests showed a significant difference between exposure conditions for: domestic rice and stout smartweed after the 30-day period, domestic rice and barnyardgrass after the 60-day exposure, red rice and junglerice after the 90-day exposure and red rice, junglerice, barnyardgrass and pink smartweed after the 120-day period. Since many seeds are usually dormant for short periods after harvest, germination results obtained after the first 30-day exposure period cannot be expected to represent the actual seed viability. A large per cent of the seed that did not germinate remained firm, indicating prolonged dormancy and soundness. During the later stages of exposure, germination results for all species except signalgrass and browntopmillet coincided closely with the number of seeds that were still viable after exposure. The results presented in Table 3 show that the germination rates for signalgrass and browntopmillet were less than 10 per cent throughout the testing periods, while a majority of the non-germinating seeds remained firm. To what extent signalgrass and browntopmillet are affected by dormancy is not known, but natural dormancy may have been the causative agent in delaying germination in these species during the laboratory tests.

As the seeds were subjected to longer exposure periods, a gradual

Table 3. Per Cent Germination of Seeds When Exposed on the Ground Surface and When Submerged in Water.

Species	Exposure Condition	Length of Exposure (Days) 0	30	60	90	120
		Per Cent				
Domestic rice	Ground surface	20.7	64.3[1]	45.5[1]	7.0	0.0
	Water	20.7	0.0	0.0	0.0	0.0
Red rice	Ground surface	8.0	45.7	79.5	23.3	1.7
	Water	8.0	34.3	87.7	97.7[1]	90.7[1]
Signalgrass	Ground surface	0.0	0.0	1.7	1.3	4.7
	Water	0.0	0.0	0.3	0.0	3.3
Junglerice	Ground surface	60.0	26.0	53.0	15.0	6.0
	Water	60.0	35.7	67.7	94.3[1]	74.7[1]
Barnyardgrass	Ground surface	7.7	1.3	17.3[1]	17.3	17.0
	Water	7.7	1.7	1.7	27.3	84.3[1]
Browntopmillet	Ground surface	4.3	4.3	8.7	6.7	0.0
	Water	4.3	1.0	1.0	5.7	2.3
Brownseed paspalum	Ground surface	2.0	45.3	70.0	63.0	32.3
	Water	2.0	44.0	56.3	57.7	45.3
Swamp smartweed	Ground surface	2.7	30.0	23.0	12.3	3.0
	Water	2.7	29.3	17.7	16.0	1.7
Pink smartweed	Ground surface	5.7	8.7	47.0	19.0	19.0[1]
	Water	5.7	1.3	34.7	19.7	2.0
Stout smartweed	Ground surface	11.0	25.0[1]	13.3	11.7	0.0
	Water	11.0	6.0	3.3	1.3	0.0

[1] Significant difference between exposure conditions at 5% level.

increase in germination rates occurred in red rice, junglerice and barnyardgrass, indicating the possibility of a relatively short dormancy period immediately after harvest. Highest germination rates were obtained for red rice, junglerice, and barnyardgrass after subjecting them to 90- and 120-day exposures, with lowest rates for these species after a 30-day exposure. Red rice, junglerice and barnyardgrass showed high germination rates of 90.7, 74.7, and 84.3 per cent, respectively, after exposure in water for 120 days. Results after ground-exposure for the same period were 1.7, 6.0, and 17.0 per cent, respectively. Destruction of ground-exposed seeds by feeding rodents, which probably ate mostly good seeds, and deterioration limited the number of viable seeds for testing and apparently caused lower germination results.

Domestic rice, signalgrass, browntopmillet, and the smartweed species had low germination rates throughout exposure indicating little seed viability after being subjected to long exposure periods. Sprouting of seeds during field exposure undoubtedly caused lower germination during laboratory tests. Early sprouting of domestic rice, which was pronounced during the mild weather that occurred during the early stages of exposure, contributed to the low germination rate. Smartweeds showed relatively low germination rates after each exposure.

Germination results obtained from control seeds were lower than expected. Anticipating dormancy of some of the plant seeds at maturity, germination tests of unexposed seeds were postponed. These seeds remained in cold storage at 35°F. from harvest until germination tests were begun approximately six months later around the first of February 1963. The effect of cold storage is not fully known, but undoubtedly it had some effect on the seeds, resulting in lower germination rates than usual.

During field exposure, seeds exposed in water were subject to less environmental destruction and remained viable until requirements were met for germination. This is most clearly demonstrated by the germination results obtained for red rice, junglerice and barnyardgrass.

When the per cent of seeds that germinated are added to the seeds that remained firm after germination, the results are inversely proportional to those obtained in deterioration tests (Table 4).

Table 4. Per Cent Germinated and Sound Seeds When Exposed On Ground Surface and When Submerged in Water.

Species	Exposure Condition	Length of Exposure (Days) 0	30	60	90	120
				Per Cent		
Domestic rice	Ground surface	97.7	79.7	56.0	8.0	0.0
	Water	97.7	0.0	1.0	0.0	0.0
Red rice	Ground surface	100.0	99.3	87.5	39.7	3.0
	Water	100.0	100.0	99.3	99.7	99.7
Signalgrass	Ground surface	100.0	99.0	97.7	36.3	21.0
	Water	100.0	99.7	99.0	100.0	99.7
Junglerice	Ground surface	98.0	99.0	83.0	15.5	6.0
	Water	98.0	97.3	95.7	98.7	92.3
Barnyardgrass	Ground surface	96.3	95.0	64.7	17.3	19.3
	Water	96.3	93.0	91.0	94.7	92.3
Browntopmillet	Ground surface	98.7	89.3	65.0	35.0	1.3
	Water	98.7	88.3	64.0	86.0	74.3
Brownseed paspalum	Ground surface	90.3	77.0	71.7	70.0	33.3
	Water	90.3	70.0	59.3	59.0	49.0
Swamp smartweed	Ground surface	88.3	50.3	33.0	19.7	8.0
	Water	88.3	36.0	43.3	33.7	26.7
Pink smartweed	Ground surface	96.0	59.0	58.7	32.7	36.0
	Water	96.0	66.0	51.0	41.3	29.3
Stout smartweed	Ground surface	73.3	34.7	24.0	32.3	14.7
	Water	73.3	22.3	36.3	25.0	19.3

Table 5. Proximate Analyses of Seeds (Percentages on Moisture-free Basis)

Treatment of Seeds	Days	Domestic Rice	Red Rice	Signal-grass	Jungle-rice	Barn-yard grass	Brown-top-millet	Brown-seed paspalum	Swamp Smart-weed	Pink Smart-weed	Stout Smart-weed
					Crude Protein						
Unexposed	0	7.2	7.8	8.4	12.0	9.0	12.4	9.1	7.8	9.1	10.4
Exposed	30	6.4	7.4	9.1	11.0	8.7	13.5	9.0	7.5	9.3	10.2
in	60	3.6	7.1	9.8	9.4	11.5	13.9	8.3	9.5	8.1	9.6
Water	90	4.3	8.1	8.5	9.8	12.4	14.6	9.1	9.5	8.1	9.6
	120	3.3	7.2	9.3	7.3	13.0	8.3	7.6	8.7	7.5	9.5
Exposed	30	7.0	7.8	9.3	8.9	9.7	13.7	8.8	8.9	7.1	9.6
on	60	7.1	7.5	9.1	8.1	12.0	13.8	8.8	9.1	7.9	10.9
Ground	90	7.5	8.0	6.3	8.9	10.9	14.0	7.9	9.5	8.1	9.6
	120	6.9	7.1	9.5	7.7	11.0	13.5	9.2	9.3	7.0	9.9
					Ether Extract						
Unexposed	0	2.7	2.6	6.6	2.6	5.2	6.5	4.0	3.6	3.4	3.0
Exposed	30	7.5	2.8	5.7	4.2	6.2	3.8	4.9	2.5	1.8	1.0
in	60	4.7	1.6	5.4	4.9	6.4	4.1	4.4	2.7	4.6	5.6
Water	90	5.7	1.1	3.9	3.1	3.5	7.3	4.4	2.4	2.4	2.0
	120	2.7	4.0	4.0	3.7	5.3	5.3	2.9	2.8	2.8	1.7
Exposed	30	1.8	2.7	5.5	4.7	3.8	5.5	3.2	1.4	0.9	0.5
on	60	3.0	1.0	4.6	3.7	4.2	4.2	3.3	2.4	2.4	2.0
Ground	90	2.4	1.9	5.5	4.5	4.2	6.1	3.1	2.6	1.7	1.2
	120	1.8	2.4	4.2	3.9	8.4	4.2	2.9	2.7	2.0	1.3
					Crude Fiber						
Unexposed	0	10.5	13.4	26.6	18.5	20.7	17.3	23.7	20.2	19.9	25.7
Exposed	30	22.4	15.3	23.2	12.4	18.3	17.1	24.2	19.4	17.7	19.2
in	60	19.5	11.2	23.7	16.8	17.2	16 9	20.6	17.5	17.4	22.1
Water	90	25.4	12.8	21.0	16.1	14.7	17.4	19.3	21.9	19.7	26.2
	120	27.8	11.8	19.9	10.1	14.8	21 4	16.1	21.4	20.7	24.5
Exposed	30	9.4	13.8	23.7	16.8	16.8	15.9	19.8	19.8	14.6	24.0
on	60	9.6	12.9	21.5	13.5	15.4	15.3	20.7	17.0	16.5	17.7
Ground	90	9.1	12.4	14.9	15.9	14.0	14.6	15.7	21.5	20.0	22.1
	120	9.4	11.3	20.8	13.5	15.4	13.7	16.3	20.8	19.8	24.4

N-free Extract

Unexposed	0	73.2	63.4	51.8	60.6	60.9	58.1	60.4	66.3	65.1	57.6
Exposed	30	44.7	68.0	50.1	53.9	61.1	45.7	53.0	62.4	66.0	62.3
in	60	21.2	56.1	50.8	56.8	47.4	50.3	59.1	60.9	63.9	56.4
Water	90	31.3	69.1	52.6	55.9	53.0	45.3	58.4	57.8	58.9	54.7
	120	29.6	56.2	50.6	44.4	56.9	50.1	53.0	60.7	59.0	50.8
Exposed	30	72.6	65.9	48.2	60.7	53.5	51.4	57.9	64.5	62.3	52.7
on	60	69.7	63.8	48.5	49.1	52.1	50.9	60.1	58.4	62.9	53.1
Ground	90	72.5	65.1	45.2	49.3	45.4	51.0	47.9	61.1	64.0	50.8
	120	64.0	58.7	54.1	52.3	40.9	47.9	59.3	57.8	59.4	50.4

Ash

Unexposed	0	6.4	7.3	6.6	6.3	4.1	5.7	2.8	2.1	2.5	3.2
Exposed	30	19.1	11.4	11.9	11.3	12.8	18.4	8.9	8.2	5.2	7.3
in	60	51.0	22.9	10.3	12.1	17.4	14.8	7.7	6.6	7.5	8.1
Water	90	33.2	9.0	14.0	15.2	16.3	14.8	8.8	8.7	11.4	7.3
	120	36.7	20.8	16.1	34.0	10.0	11.9	20.4	6.4	10.0	13.3
Exposed	30	9.2	9.9	13.3	8.8	16.1	13.6	10.4	7.6	12.9	13.2
on	60	10.7	14.2	16.4	25.7	16.3	15.6	7.2	13.0	10.3	16.3
Ground	90	8.5	12.7	26.2	21.4	24.4	14.3	25.4	5.3	6.5	16.3
	120	18.0	20.6	11.5	22.2	24.3	20.7	11.6	9.4	11.7	13.9

Calcium

Unexposed	0	.04	.06	.10	.08	.12	.06	.11	.20	.20	.29
Exposed	30	.24	.12	.10	.09	.09	.08	.17	.30	.27	.30
in	60	.29	.10	.09	.09	.09	.15	.06	.31	.33	.40
Water	90	.29	.06	.08	.10	.08	.12	.23	.42	.39	.34
	120	.46	.12	.08	.12	.11	.08	.24	.42	.45	.49
Exposed	30	.07	.06	.09	.11	.08	.13	.13	.17	.16	.22
on	60	.06	.06	.07	.12	.08	.11	.07	.24	.24	.38
Ground	90	.08	.08	.08	.11	.08	.08	.14	.27	.30	.29
	120	.07	.10	.08	.05	.08	.06	.08	.39	.24	.30

Phosphorous

Unexposed	0	.31	.31	.37	.47	.42	.42	.17	.31	.30	.41
Exposed	30	.19	.35	.34	.54	.40	.33	.20	.27	.25	.25
in	60	.14	.25	.35	.42	.42	.31	.05	.31	.26	.28
Water	90	.14	.36	.33	.35	.54	.33	.20	.29	.25	.30
	120	.15	.29	.32	.30	.52	.27	.16	.27	.25	.26
Exposed	30	.34	.34	.32	.39	.39	.41	.13	.30	.26	.32
on	60	.30	.30	.30	.36	.46	.43	.19	.32	.37	.29
Ground	90	.26	.32	.22	.34	.38	.22	.16	.36	.30	.27
	120	.27	.30	.42	.38	.45	.41	.16	.25	.25	.30

Loss of Chemical Nutrients

Proximate analyses of seeds of each plant species were made in an attempt to ascertain any apparent change in nutrient content due to field exposure. On a moisture-free basis, which eliminates the obscuring effect of water content, proximate analyses indicated only minor differences between the exposure conditions and the exposure periods. Table 5 presents a summary of the results.

Only trends in nutrient content, as affected by exposure, can be considered since only one sample was analyzed for each exposure condition. Although data obtained were not adequate to allow definite conclusions to be drawn, some interesting relationships were apparent.

Crude Protein. The crude protein content showed no appreciable difference between exposure conditions with the exception of domestic rice, which has a high deterioration when exposed in water. Crude protein increased only slightly for barnyardgrass, swamp smartweed, and stout smartweed, while junglerice and pink smartweed along with domestic rice showed a decrease during exposure. The crude protein content of red rice, browntopmillet and brownseed paspalum remained somewhat stable throughout exposure without any apparent effect from either exposure condition.

Ether Extract. The values obtained for ether extract (fat) were variable and showed no definite trend in either an increase or decrease during exposure. Signalgrass and the smartweeds indicated a slight decrease in content.

Crude Fiber. Throughout exposure the smartweeds remained quite stable in crude fiber while the other species, except domestic rice, showed a decrease. However, domestic rice also showed a decrease when exposed on the ground, but when exposed in water, it showed a considerable increase. This increase, after exposure for 120 days, was approximately three times the original content. Crude fiber is the more resistant woody material remaining after the proteins, fat and carbohydrates are removed by hydrolysis. It is considered by most authors to be largely indigestible by waterfowl.

N-Free Extract. Signalgrass showed no apparent change in N-free extract during exposure while all other species showed a decrease. Domestic rice had a drastic decrease in N-free extract when exposed under water.

Ash. Ash content showed a substantial increase during exposure for all species, with only minor differences between exposure conditions. However, domestic rice had a larger increase in ash content after exposure in water and barnyardgrass showed a larger increase after exposure on the ground.

Calcium. An increase in calcium was obtained for domestic rice, brownseed paspalum and the smartweeds with a greater increase occurring in samples exposed in water. However, the smartweeds also showed a substantial increase in calcium during exposure on the ground. Other species showed only minor changes in calcium.

Phosphorous. Exposure in water resulted in a decrease in the phosphorous content of domestic rice, browntopmillet, and stout smartweed seeds, with no apparent change in phosphorous content due to exposure on the ground. Other species had no appreciable difference in phosphorous content during exposure.

In general, the effect of exposure on the nutrient content of seeds appeared negligible, with the exception of domestic rice, which did show a large decrease in nutrients when exposed in water.

Recommendations for Management

The flooding of ricelands as a waterfowl management practice is more complicated than previously believed. A flooding program should be worked out to meet the landowners' objectives. Domestic rice is the most abundant waterfowl food in nearly all recently harvested ricefields. Results obtained in this study show that the quality and quantity of domestic rice decreases rapidly whether flooded or exposed on the ground. But deterioration is more rapid under flooded conditions.

Harmon (1960) and Rumsey (1961) showed equivalent losses in a similar period during the fall and winter on nine rice farms in southwest Louisiana. However, Neely (1956), working in South Carolina, found only a 19 per cent deterioration of domestic rice under flooded conditions for a period of 90 days.

It is well known that ducks prefer to feed in flooded fields but that they will feed on dry land. Since it is apparent that the losses of rice will be extremely high whether the land is flooded or not, it is recommended that the rice be made available for quick utilization by waterfowl as soon as they arrive on the wintering ground. Therefore, it is recommended that newly harvested ricefields be flooded about October 25 just prior to the time heavy flights of ducks normally arrive in Louisiana. Earlier flooding would prevent depredations by passerine birds and mammals but it would also allow a longer time for deterioration and would attract early flights of teal. Early and prolonged shallow flooding of extensive areas should be considered as a possibility to hold teal and pintails that normally go to more southern wintering areas.

The results of this study as well as results from studies by Harmon (1960), Rumsey (1961) and Davis (1961) show that the rate of loss of seeds from wild plants is much less than for domestic rice. It was also shown in this study that the loss was much reduced under flooded conditions.

Fallow ricefields contain large quantities of seed of wild plants and seldom contain seeds of domestic rice. When seed predators are not overly abundant, it is recommended that fallow fields be flooded about November 25. This would provide an abundant food supply for ducks about the time the waterfowl hunting season begins. It is likely that ducks would use these fields until spring migration. If seed predators are abundant, flooding should be done at an earlier date.

LITERATURE CITED

Association of Official Agricultural Chemists. 1955. Official methods of analysis. Eight ed. A.O.A.C., Washington, D. C. 1005 p.

Davis, J. P. 1961. Foods available to waterfowl in fallow ricefields of southwest Louisiana, 1960-61. M.S. Thesis, Louisiana State University, Baton Rouge, La. 58 p.

Harmon, B. G. 1960. Waterfowl food in Louisiana ricefields. M.S. Thesis, Louisiana State University, Baton Rouge, La. 52 p.

Neely, W. W. 1956. How long do duck foods last underwater? Trans. 21st N. A. Wildl. Conf., 21:191-198.

Neff, J. A. and B. Meanly. 1957. Blackbirds and the Arkansas rice crop. Ark. Agric. Exp. Sta. Bull. 506. 59 p.

Rumsey, R. L. 1961. Waterfowl foods in ricefields of southwest Louisiana. Thesis, Louisiana State University, Baton Rouge, La. 45 p.

Stoddard, H. L. 1931. The bobwhite quail; its habits, preservation and increase. Chas. Scribner's Sons, N. Y. 559 p.

WOOD DUCK TRAPPING TECHNIQUES

BY

DONALD J. HANKLA AND PARKER B. SMITH
Bureau of Sport Fisheries and Wildlife

Presented at
Seventeenth Annual Conference
Southeastern Association of Game and Fish Commissioners
Hot Springs, Arkansas
October, 1963

INTRODUCTION

The recent decline in waterfowl populations has not only focused attention on year-round habitat needs but has, in fact, placed increased emphasis on "species management." One species that has particular management significance in the Atlantic and Mississippi Flyways is