

11 – Insect Management in Rice

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Many insects and spiders are found in rice fields, but only a few insects are considered pests of rice. Insects damage rice by feeding on the leaves, stems, roots or grain. This section contains a brief description of crop injury, scouting procedures and control methods for the major and minor insect pests of rice. Insecticide application should be considered only when insect numbers reach levels that may reduce rice yield and/or quality. Be reminded that many crop production practices directly influence insect populations. Use of best management practices can reduce insect pests and insecticide applications.

Major Pests of Rice

Rice Water Weevil

[*Lissorhoptus oryophilus* (Kushel)]

Adult rice water weevils are snout beetles about 1/8 inch long. When dry, the adults are grayish-brown with black markings on the back, but are uniformly dark brown when wet. Eggs are placed in the leaf sheath and are fragile, pearly-white, cylindrical with rounded ends and about 1/32 inch in length. The larvae, sometimes called “root maggots,” are white, legless, range in size from 1/32 to 3/16 inch in length and have a brown head. Abdominal segments two through seven have a pair of hooks on bumps on the dorsal surface of the body. The hooks are primarily used to obtain oxygen from plant roots and may also be used to aid in movement. Pupation occurs in an oval, watertight silken cocoon covered with a thin layer of soil which is attached to the roots.

Adults enter diapause and overwinter in accumulated leaf litter around trees, in the base of bunch grasses and in other sheltered places. The indirect flight muscles degenerate while adults overwinter. In the spring, flight muscle regeneration is regulated by temperature. Following flight muscle regeneration, adults leave overwintering sites usually in late April through late May and fly during early morning and evening hours. Adult rice water weevils are

attracted to open water. Adults feed on host plants, including rice, leaving white linear feeding scars parallel to the leaf veins and midrib. Leaf scarring can be heavy, but even the heaviest scarring will not result in yield loss. Heavy scarring is usually seen in field areas with deep water and/or thin stands, such as near the levees. Feeding by adults on rice leaves will begin soon after emergence and continue until after internode elongation. In flooded rice fields, the indirect flight muscles of 80 to 90 percent of adults begin to degenerate and render adults flightless in about five to seven days.

Females begin to lay eggs about one to two weeks after emergence from overwintering but only when part of the host plant is submerged in water. The majority of eggs are deposited within two weeks. Eggs hatch in four to nine days (depending on temperature). The larvae may feed in the leaf sheath for a short time before chewing a hole in the leaf, sinking to the soil surface and burrowing into the soil to feed on roots. Larvae are the damaging part of the life cycle. Small larvae often enter the larger roots to feed and cause the death of the whole root. Larger larvae damage roots through external feeding.

When the rice root system is damaged by larval feeding, plant uptake of nutrients is reduced and plants may exhibit nutrient (usually N) deficiency symptoms. Plants will not usually show deficiency symptoms unless root damage is severe or availability of nutrients is low. Severe root pruning may cause rice to turn yellow, reduce growth (stunting), delay maturity and, when severe, reduce yields. Plants with a severely pruned root system may lean in the water or float when physically disturbed. Larvae complete development in about four weeks. The pupal stage lasts another seven to ten days. The time from egg until adult takes about 35 to 40 days.

Overwintered adult rice water weevils begin to die in July. First generation adults (from hatched eggs) feed on rice leaves from June to

early September before finding a site to overwinter. A small percentage of the first generation adults will deposit eggs in rice, resulting in a partial second generation. Adult weevils are commonly found on rice panicles. Adults will feed on the rice flowers when the hulls are open and the floral parts are exposed. However, the rice hull is an effective barrier and keeps adults from feeding on the kernel. Economic damage is not expected from rice water weevil adults found on rice panicles.

The severity of rice water weevil infestation in any rice field is related to several factors: (1) the weevil population in the area during previous years, (2) availability and proximity of “good” overwintering sites, (3) overwintering survival, (4) the sequence of flooding of rice fields in the area, (5) rice cultural seeding method, drill-seeded or water-seeded and (6) stand density, water depth and rice variety.

Yield loss attributed to rice water weevil damage is usually greater in water-seeded than in drill-seeded fields. Water-seeded rice will begin to attract adults when seedlings (one to two leaf with a small root system) emerge from the water and will continue to attract adults for several

weeks. In comparison, drill-seeded rice has four or five leaves, a developed tiller(s) and a more developed root system when flooded. Thus, drill-seeded rice is attractive to colonizing adult rice water weevils for only one or two weeks after flood establishment. Larval densities peak 21 to 35 days after flooding in drill-seeded rice and 28 to 42 days after permanent flooding in water-seeded rice. Adults and larvae are usually present in higher densities for a longer time in water-seeded rice.

Two methods of scouting are currently available – leaf scar counts and larval counts.

Leaf scar counts in drill-seeded rice.

Begin scouting and using leaf scar counts four to seven days after the permanent flood is established. Examine only the youngest mature leaf for adult feeding scars on plants at least 6 feet from levee furrows (barrow or bar ditch). Scouting procedures should ensure that representative field areas are scouted. At each stop inspect 40 plants and record the number of plants with at least one scar on the youngest mature leaf. Use Table 11-1 to decide whether to stop or continue scouting. If a treatment decision cannot be made

Table 11-1. Scouting Techniques for Rice Water Weevil Using the Leaf Feeding Scar Method¹

Stop Number ³	Total Number of Plants With Feeding Scars on New Leaves ²		
	Don't Treat Stop Scouting When Total Is Less Than	No Decision ⁴ Keep Scouting When Total Is	Treat Stop Scouting When Total Is More Than
1	ND ⁵	Between	40
2	11	Between	56
3	29	Between	72
4	44	Between	89
5	61	Between	105
6	78	Between	122
7	94	Between	139
8	111	Between	156
9	128	Between	173
10	145	Between	189

¹Best results when used within 7 days after first flood.

²Inspect the youngest unrolled or mature leaf on 40 rice plants at each stop in the bay area at least 6 feet from levee or area with a thin stand. The youngest mature leaf will have a visible collar at the base where the leaf blade meets the leaf sheath.

³Total number of leaves with scars should be accumulated. (Example: stop 1 total, plus 2 total, plus 3 total, etc.)

⁴If a decision is not reached within a reasonable number of stops, either reinspect field in 4 to 5 days or follow trend. (Example: Treat if totals progressively move toward treat level. Do not treat if levels progressively move toward the don't treat level.)

⁵No decision can be made – continue scouting.

after a reasonable number of stops, scout the field again in three to five days. When the percentage of the youngest mature leaves with feeding scars exceeds 60 percent, the number of larvae per core sample will likely reach or exceed ten larvae per core and justify control measures.

For water-seeded rice, begin scouting and using leaf scar counts when seedlings emerge from the flood. Follow the same procedures as described for drill-seeded rice. When the percentage of plants with at least one adult feeding scar on the youngest mature leaf equals or exceeds 50 percent, an insecticide application is recommended. The treatment threshold is lower for water-seeded rice because rice plants are smaller and more susceptible to damage. Leaf scar thresholds for water-seeded rice are preliminary and subject to change with additional research, so check with your county Extension agent for the latest recommendations. For control of rice water weevil adults, the leaf-scar method should be used for only the first two weeks after the permanent flood is established regardless of the cultural seeding method.

Larval scouting. Scouting for larvae is the same for drill-seeded and water-seeded rice and should not be used until two to three weeks after permanent flooding. Larval counts were useful for timing Furadan 3G (carbofuran) application. However, Furadan can no longer be used for rice water weevil larval control, and other larval control measures are not currently available. Therefore, larval counts are useful only to time or make nonchemical management decisions that may reduce larval injury or aid in plant recovery.

Rice plants and soil that surrounds the root system can be used to determine the larval infestation. The size of the soil/plant sample should be 4 inches in diameter and 3 to 4 inches deep in a silt loam soil and 2 to 3 inches deep in a heavy clay soil. Place the soil/plant sample in a bucket that has a 40-mesh screen bottom. Wash the soil from the plants by vigorously swirling the plants in the water to dislodge larvae from the roots. Move the bucket vigorously up and down in the water several times to help wash away the soil. Most larvae will float to the water surface and can be removed from the bucket and counted. Continue to repeat the soil removal motions and larval counts until no additional larvae float to the surface or are visible in debris inside the bucket. Additional samples may be needed in large fields. The number and size of larvae can be used to predict how much damage has and/or will

occur in dry-seeded rice, **if the samples are taken during peak densities.** (Guidelines for water-seeded rice are not available at this time.)

1. If the average larval density exceeds 20 per core and root pruning has occurred, yield loss will be variable but expected and cultural control may be necessary to reduce losses.
2. If the average is between 10 and 20 per core and root pruning is not evident, little or no yield loss can be expected and cultural control is discretionary.
3. If the average density is less than 10 per core, minimal yield loss attributed to rice water weevil damage is expected.

Control of rice water weevils can be accomplished by cultural or chemical means (Table 11-2). One alternative to insecticide control is water management. Often called “drain and dry,” this cultural practice involves the removal of water from the field 10 to 14 days after permanent flooding. The DD50 period for drying soil for straighthead prevention can also be used for rice water weevil control. Drying the soil is effective if the soil is allowed to dry thoroughly. Incomplete drying may not sufficiently reduce the number of larvae. Draining and drying the soil needs to be accomplished in ten days or, preferably, less. Rain or slow drying conditions may reduce its effectiveness. “Drain and dry” is a remedial cultural practice that should be considered if currently registered insecticides were not used and scouting has shown a density of larvae that may cause enough damage to reduce the yield. Other factors such as water availability, weed control, straighthead history or variety susceptibility, fertilizer management and growth stage must be considered before drying a field for rice water weevil control.

Another alternative to insecticides is supplemental nitrogen application. Growers commonly apply extra N fertilizer to treat the N deficiency symptoms that result from damage to the rice root system. Research data is presently unavailable to confirm the benefit of supplemental N application. The efficiency of fertilizer N uptake by plants with damaged root systems is reduced. However, application of low N rates (30 to 45 pounds N per acre) near, but before, midseason may help damaged plants recover. Midseason N application rates may also need to be increased to compensate for larvae damage. Be aware that application of extra N fertilizer is treatment of a

Table 11- 2. Insecticides Labeled for Rice Water Weevil and Rice Stink Bug Control¹

Insect	Type of Damage	Timing of Treatment	Treatment	Product/Acre
Rice Water Weevil adults	Prevent adults from laying eggs	Drill-Seeded: Within 10 days after permanent flood when adults are present. Water-Seeded: Within 7 days after permanent flood when adults present; a second application may be necessary 5 to 7 days later	Karate Z 2.09CS (lambda-cyhalothrin) 0.025 - 0.04 lb ai/acre	1.54 - 2.46 fl oz
larvae	Prevent larvae from damaging roots	Seed Treatment	ICON 6.2 FS 0.025 - 0.5 lb ai/acre	0.5 - 1.0 fl oz
eggs	Prevent eggs from hatching	Drill-Seeded: Within 10 days after permanent flood when adults are present. Water-Seeded: Within 7 days after permanent flood when adults present; a second application may be necessary 5 to 7 days later	Dimilin 2L (diflubenzuron) 0.125 -0.25 lb ai/acre	12 to 16 fl oz
Rice Stink Bug (nymphs and adults)	Both stages suck juices from kernel, causing blanks and/or discolored rice kernels	5 bugs per 10 sweeps at heading; 10 bugs per 10 sweeps 2 weeks after heading	Malathion 57% EC Cythion 5EC (Malathion) Sevin 80S, 80WSP Sevin 4L, 4F,XLR Methyl parathion 4EC PennCap M	0.5 - 1 pt 0.5 - 1 pt 1.25 to 1.87 lbs 2 - 3 pt 1/2 to 1 pt 2 pt

¹Labels are frequently changed, so always check the most recent label of any insecticide for directions and restrictions before application. Insecticides applied to heading rice have a preharvest interval. Be sure to know the preharvest interval before application.

symptom caused by the larval feeding. Extra N may help if the larval population has peaked and is declining.

Three insecticides are currently available for rice water weevil control and are listed in Table 11-2. Karate Z is a synthetic pyrethroid insecticide applied only for the control of rice water weevil adult. Application(s) should be timed when adults are abundant but before peak egg laying occurs. For drill-seeded rice, peak egg laying could occur between five and 14 days after permanent flooding. An application of Karate Z can be timed with leaf feeding scars or on days after flooding if a field history of rice water weevil damage is available. A single application timed

between five to ten days after permanent flooding will give adequate control in most rice fields, when needed. Application ten days after flooding will not likely give adequate control since peak egg laying may have occurred.

In water-seeded rice, Karate Z should be applied when adults are present and leaf scars are found on 50 percent of the youngest leaves. Carefully scout water-seeded rice after the first application for the presence of adult weevils since a second application may be necessary five to seven days after the first application. Karate Z applications, whatever the seeding method, should be made during the morning hours (approximately 9:00 to 11:00 a.m.). Application

during this time will be most effective due to the behavior of adult weevils. Karate Z may have a short residual time depending on application rate and environmental conditions. Karate Z does not interact with herbicides. The recommended rate for rice water weevil control is 0.03 pound ai per acre (1 gallon of Karate Z 2.09CS per 70 acres). Labeled application rates range from 0.025 to 0.04 pound ai per acre. Always check and follow the most recent label of any insecticide for use directions and restrictions.

Dimilin 2L is an insect growth regulator that has activity against rice water weevil eggs. Dimilin needs to be in the water when adults are present and actively laying eggs. Timing of Dimilin application(s) will be the key to controlling rice water weevil. **For drill-seeded rice, application timing and scouting methods are identical to those previously stated for Karate Z.** The recommended Dimilin 2L rates that have been tested are 0.187 and 0.25 pound ai per acre (12 or 16 ounces of product per acre). In water-seeded rice, Dimilin should be applied when adults are present and leaf scars are found on 50 percent of the youngest leaves. A split application of 0.095 or 0.125 pound ai per acre (6 or 8 ounces per acre) after the leaf scar threshold is reached followed by another 0.095 or 0.125 pound ai per acre (6 or 8 ounces per acre) in five to seven days will improve control of rice water weevil. The split application is recommended for water-seeded rice since egg laying is extended and the peak may not occur until seven to 28 days after permanent flooding. A split application in dry-seeded rice may improve control of rice water weevil if infestation is continuous (extended). Dimilin does not interact with herbicides.

ICON is an insecticide seed treatment that can only be applied by registered seed dealers. ICON is used to prevent injury from rice water weevil larvae. Use of ICON must be based on field history of rice water weevil problems or as insurance against larval damage. ICON is effective in both drill-seeded and water-seeded rice. However, rice seed intended for water seeding cannot have ICON applied before soaking/ pregerminating seed. ICON must be applied by a seed dealer after seed has been soaked and allowed to drain for at least four hours. The recommended application rates range from 0.025 to 0.05 pound ai per acre. Table 11-3 can be used to ensure that the application rate does not fall below the lowest recommended rate due to different seeding rates. Application rates below 0.025 pound ai per acre will substantially reduce residual activity and control. ICON does not interact with rice herbicides. ICON will effectively control rice water weevils if dry-treated seed is dropped into flooded fields. However, if a residual herbicide such as Bolero® (thiobencarb) or Ordram® (molinate) is applied before seeding, do not apply dry ICON-treated seed into the flood. Herbicide injury to rice seedlings may occur and result in reduced stand density. If ICON-treated seed is planted, germination or seedling survival is poor due to adverse weather conditions and replanting is needed, sufficient residual ICON will be available to give adequate rice water weevil control. Therefore, seed used for the replanting does not need to be treated with ICON. Other current label restrictions for ICON are (1) the use of ICON in a rice field prohibits rotation of small grains other than rice for 12 months into the same field, (2) root and leafy vegetable crops in rotation are restricted to five

Table 11-3. ICON Application Rate and Seeding Rate Combinations¹

ICON Rate	Anticipated Seeding Rate, lbs rough rice seed/acre									
	60	70	80	90	100	110	120	130	140	150
lb ai/cwt	lb ICON ai/acre									
0.025					0.025	0.0275	0.030	0.0325	0.035	0.0375
0.03125			0.025	0.0213	0.0313	0.0344	0.0375	0.0406	0.0438	0.0469
0.0375		0.0266	0.0304	0.0342	0.0375	0.0418	0.0456	0.0494		
0.04425	0.0266	0.031	0.0354	0.0398	0.0443	0.0487				
0.05	0.03	0.035	0.04	0.045	0.05					

¹Shaded areas on table represent application rates above or below the recommended rate.

and one month, respectively, (3) production of fish, shellfish and crustaceans (crawfish) in fields planted with ICON-treated seed are also prohibited before rice harvest and (4) check the most recent label for restrictions on water released from fields treated with ICON and reused in or near crawfish ponds.

Rice water weevils have several natural enemies that provide some degree of biological control. A mermithid nematode was discovered in a small percentage of adults. The extent and control provided by this nematode remain unknown. Several aquatic predators found in rice fields may also attack adult weevils. Long-horned grasshoppers and small green katydids, common in and near all rice fields, readily feed on adult weevils when adults become numerous shortly after permanent flooding. The impact of all general aquatic predators remains unquantified.

Rice Stink Bug [*Oebalus pugnax* (F.)]

The adult rice stink bug has reddish antennae and a body similar to the color of mature rice grains. The rice stink bug's body is about 3/8 to 1/2 inch in length. The rice stink bug can be distinguished from other stink bugs by the pointed spines, with points directed forward and slightly outward, that are located on the shoulders. Adult stink bugs overwinter in accumulated leaf litter around trees, in the base of bunch grasses and in other sheltered places. Emergence from overwintering sites generally begins in April and continues to the end of May, depending on the temperature and location in Arkansas.

The rice stink bug has several cultivated and wild plant hosts. Cultivated hosts include grain sorghum, oats, rice, rye and wheat. There are about 40 wild host plants, but the availability of barnyardgrass, bearded sprangletop, dallisgrass, lovegrass (*Eragrostis* sp.), ryegrass (*Lolium* sp.), crabgrass, broadleaf signalgrass and several species of *Panicum* are very critical to seasonal stink bug populations. Weedy grasses (wild host plants) are essential to rice stink bug survival, but eggs are not placed in all host plants upon which adults feed. Stink bug longevity (life span) and fecundity (number of eggs) are influenced by which host plants stink bug nymphs and adults feed on.

Stink bug eggs are always placed in two parallel lines on leaves, stems or panicles of host plants. Each egg mass contains 10 to 40 eggs.

Individual eggs are barrel-shaped and about 1/25 inch long and 1/32 inch in diameter. When first laid, stink bug eggs are green, but eventually turn red before hatching. Eggs hatch in four to seven days, depending on temperature, and first instar nymphs remain clustered around the egg shells. Nymphs pass through five distinct instars and do not have wings or shoulder spines. The first instar is about 1/25 inch long with all black body parts except the abdomen which is red with two or three black spots. The second through fifth instars gradually increase in size and are light brown with red and black spots on the abdomen. First instars do not feed on rice. The second through the fifth instar nymphs primarily feed on seeds. Total time spent as a nymph is between 15 and 28 days.

Female stink bugs start egg-laying three or four days after becoming an adult. Egg laying gradually decreases and eventually stops in old adults. Adult stink bugs that overwintered begin to die in mid July. Adults, like nymphs, feed primarily on seeds and remain active in host plants until the host plant becomes senescent or cool weather arrives. At least four generations of rice stink bug occur each year in Arkansas.

Adults and nymphs have piercing-sucking mouthparts. Entry of the stylets (mouthparts used for feeding) is facilitated by a salivary secretion that hardens on contact with air and remains attached to the rice grain. The secretion is called a feeding sheath. The feeding sheath is the only external evidence that feeding by rice stink bugs has occurred on grain. No hull discoloration is associated with feeding by rice stink bugs. The stylet penetrates the hull allowing the stink bug to feed on the developing rice kernel. The amount and type of rice stink bug damage depends upon the stage of rice kernel development. Feeding at any time before the milk stage stops any further development of the kernel (yield loss). Feeding during the milk and soft dough stages may result in the removal of all or part of the contents (also a yield loss). Pathogens are introduced into the kernel by rice stink bug feeding. Infection of the kernel by pathogens (fungi and bacteria) and enzymes produced by the rice stink bug can cause discoloration and weakening of the kernel (quality loss). Discolored kernels often break during milling procedures (quality loss). During the first two weeks of heading, damage from each adult rice stink bug will total two to six lightweight kernels and two to six discolored kernels per day. During the third and fourth weeks after heading, adult feeding activities will

cause one to five discolored kernels and one to two light weight kernels per day. Grains discolored by rice stink bug feeding activity remain attached to the panicle. Lightweight, damaged kernels are often lost with straw and chaff at harvest. Partially filled and discolored kernels are mixed with undamaged grain.

Excessive amounts (1 percent or higher) of discolored kernels in grain results in lower grade and price when the grain is sold. All discolored kernels, whatever the cause, are called "pecky rice." Rice stink bugs are not the sole cause of pecky rice but contribute to the total. Control of potentially damaging populations of rice stink bugs can reduce the amount of discolored kernels and improve rice grade, quality and selling price.

Stink bug populations in rice fields should be scouted weekly or preferably twice weekly beginning at 75 percent panicle emergence and continuing until grain maturity (30 to 35 days after 50 percent heading). Scouting during the morning hours of 8:00 to 11:00 a.m. will provide better estimates of rice stink bug densities. Rice stink bug adults are alert to disturbances and movement and are quick to fly. Scouting is best done using a 15-inch diameter insect sweep net to sample rice stink bugs. At each sample site, make ten consecutive 180 degree sweeps to the sides and front while walking forward and swinging the net from side to side. Make sure the lower half of the net is drawn through the panicles and foliage. After each ten sweep sample, grasp the net under the ring to keep the insects from escaping. Slowly open the net and count adults and nymphs of the rice stink bug. Repeat the sampling procedure at several random sites (six or more). Calculate the average number of rice stink bugs per ten sweeps. Usually, weedy host plants are more abundant along field margins and will attract more rice stink bugs. When sampling near weedy areas and field borders, note the stink bug counts in these areas. Treatment of field borders or isolated field areas where stink bugs are concentrated, rather than the entire field, may be feasible.

Insecticide application is recommended if stink bug densities average five or more per ten sweeps during the first two weeks after heading; or an average of ten or more per ten sweeps are found during the third and fourth week after heading. If the sampled density is slightly above or below the threshold or if the field is very large, additional samples will improve confidence in population estimates. Insecticides available for

control of rice stink bugs are listed in Table 11-2. Consult the insecticide label for the preharvest interval and application rate before use.

Methyl parathion gives a high and rapid kill with very little residual activity. Sevin and PennCap-M (encapsulated methyl parathion) have good initial kill and provide three to seven days of residual activity. Small plot studies with Karate Z in Arkansas have given variable results. Initial kill was between 40 and 60 percent compared to 100 percent for methyl parathion. Karate Z has shown little, if any, residual activity on caged rice stink bugs. Insecticide treatments during the morning hours after the dew evaporates or in the early evening will improve control. When high stink bug densities are observed along field margins and low densities are within the field, treatment of field borders using a quick kill insecticide should be considered.

Several predators and parasites have been reported to attack rice stink bugs and are important biological control agents. Among them are parasitic flies (Tachinidae) that attack nymphs and adults but at low levels of parasitism (2 percent or less). Tiny wasps may also parasitize and kill eggs. The wasp parasite (*Telenomus podisi*) has been very active in all host plants of the rice stink bug. High levels of control (greater than 90 percent) have been documented in wild host plants when rice stink bugs are concentrated. Egg masses that are black, not the usual red or green, show parasitism by the wasps. Blackbirds (occasionally) and green tree frogs (often) feed on rice stink bug adults and long-horned grasshoppers will feed on eggs and nymphs.

Wild host plants are important to the survival and abundance of rice stink bugs. Reduction of weed hosts in and around rice fields will aid in the reduction of rice stink bugs. Rice variety and grain size (long, medium or short) are also important factors that influence the amount of rice stink bug damage. Usually, stink bug damage is greatest in short grain varieties and least in long grain varieties (Table 11-4). Seeding date may also influence the amount of stink bug damage. Rice stink bugs may concentrate in the earliest maturing fields.

Minor Rice Insects

Rice is sometimes damaged by insects that originate in and prefer crops other than rice. Examples of these crossover pests include the grape colaspis, armyworm and aphids. Occasionally

Table 11-4. Susceptibility of Selected Rice Varieties to Rice Stink Bug^{1,2}

Short Grains		Medium Grains		Long Grains					
Nortai	8	Bengal	7	Alan	6	Lemont	5	L201	4-5
S201	7	M202	7	Cocodrie	6	Tebonnet	5	Maybelle	4-5
Koshihikari	7	Lafitte	6	Newbonnet	5-6	Litton	5	Gulfmont	4-5
Akitacomochi	7	M201	5	Priscilla	5-6	Drew	5	Jefferson	3
		Saturn	5	Wells	5-6	Cypress	5	Kaybonnet	3
		Mars	4	Jackson	5	Madison	5	LaGrue	2
				Millie	5	L204	5	Katy	2

¹Data summarized from the Arkansas Rice Performance Trials, Uniform Regional Rice Nursery, and other tests where the amount, by weight, of kernels discolored by the rice stink bug was measured.

²Susceptibility rating, 1 = least susceptible to 10 = most susceptible.

rice stalk borers, billbugs, rice seed midges, short-horned grasshoppers, fall armyworms, chinch bugs or rice root aphids will become numerous and may cause noticeable damage to rice. A brief description of these pests and possible cultural and chemical control measures are provided in the following section.

Grape Colaspis or Lespedeza Worm [*Colaspis brunnea* (F.)]

Adults are golden-brown beetles about 3/16 inch in length but oval in overall shape. Larvae are white grubs about 1/4 inch in length with a brown head. Grape colaspis larvae can be distinguished from other white grubs with use of a 10X lens by identification of ventral fleshy projections bearing a few hairs at the ends on the abdominal segments.

Larvae and adults are commonly found in legumes such as lespedeza and soybean. Multiple generations per year are common in legumes. The last generation of larvae descends deep into the soil to overwinter. In the spring, grape colaspis larvae move up toward the soil surface and resume feeding. Because leguminous crops are rotated with rice, larvae often only have rice on which to feed. When overwintered larvae reach the root zone, feeding occurs on the seedling rice roots and the portion of the plant stem (mesocotyl) between the germinated seed and the soil surface. Larvae girdle the below ground stem until only an unsevered threadlike portion remains. Girdled seedlings become yellowed, stunted and wilted. Under water stress, many damaged plants will die. These symptoms resemble and, therefore, are easily confused with seedling disease and salinity injury. Plants with less than two leaves are very susceptible to damage by grape colaspis. Older plants may also be injured, but more damage is

necessary for these plants to show above-ground symptoms. Some larvae complete development on rice, pupate and adults emerge later in the spring. In general, grasses, including rice, are not host plants for adults and are not used for egg laying.

When rice follows lespedeza in rotation, 80 to 100 percent injury and/or stand loss may occur with very high larval densities. Low to moderate densities are often found when rice follows soybeans in rotation. Areas of damage are randomly distributed and characterized by 6- to 10-inch row sections with plants showing damage symptoms. Silt and sandy loam soils will have more problems with grape colaspis than heavy clay soils. Increased use of reduced tillage rice production systems on silt and sandy loams has shown a higher frequency of problems with grape colaspis.

No formal sampling plan is available to scout for grape colaspis. Often, below-ground damage is completed before above-ground symptoms are noticed. If grape colaspis damage is suspected, examine the seedlings, roots and soil from a 2- to 4-inch deep soil sample. Carefully inspect plants for evidence of grape colaspis damage.

Methods to reduce grape colaspis damage in dry-seeded rice are (1) use deep spring tillage to reduce larval survival and (2) after damage is first noticed, flush fields and hold water for at least 48 hours. Flushing may kill some small larvae. Maintaining adequate soil moisture will prevent water stress and may allow moderately to slightly damaged seedlings sufficient time to recover. Grape colaspis injury occurs only to dry-seeded rice. Use of ICON 6.2FS treated seed will control grape colaspis larvae and prevent damaged plants (Table 11-5). Fields with a consistent history of severe grape colaspis damage should consider use of ICON-treated seed.

Table 11-5. Insecticides Labeled for Control of Other Rice Insects¹

CAUTION: Insecticides listed for rice insect control may interact with propanil causing severe injury to rice unless timed properly. Do not apply malathion or Sevin within 14 days before or after propanil applications. Do not apply methyl parathion within 7 days before or after propanil application. If insecticides are necessary and the time frame suggested cannot be followed, consider herbicide options other than propanil.

Insect	Type of Damage	Timing of Treatment	Treatment	Product/Acre
Short-Horned Grasshoppers (nymphs and adults)	Leaf feeding and head damage	Treat where damage is evident; border treatment may be beneficial	Sevin 80S, 80WSP Sevin 4L, 4F,XLR Methyl parathion 4EC Penncap M Karate Z Malathion	1.25 to 1.87 lbs 2 - 3 pt 1/2 to 1 pt 1 - 3 pt 1.54 - 2.46 fl oz 0.5 - 1 pt
Chinch Bug (nymphs and adults)	Reduce plant stand by sucking sap	When insects are causing stand reduction	Methyl parathion 4IEC Sevin 80S, 80WSP Sevin 4L, 4F,XLR ICON 6.2FS (seed trt)	1/2 to 1 pt 1.25 to 1.87 lbs 2 - 3 pt 0.5 - 1.0 fl oz
Armyworm (larvae)	Plant feeding may reduce stand or delay growth	When insects are causing stand reduction	Sevin 80S, 80WSP Sevin 4L, 4F,XLR Karate Z Methyl parathion 4EC	1.25 to 1.87 lbs 2 - 3 pt 1.54 - 2.46 fl oz 1/2 to 1 pt
Rice Stalk Borer (larvae)	Cause dead hearts before heading and whiteheads at heading	Preventive seed treatment	ICON 6.2FS	0.5 - 1.0 fl oz
Rice Seed Midges (larvae)	Reduce plant stand in water-seeded rice	Preventive seed treatment	ICON 6.2FS	0.5 - 1.0 fl oz
Grape Colaspis (lespedeza worm) (larvae)	Reduce plant stand in drill-seeded rice	Preventive seed treatment	ICON 6.2FS	0.5 - 1.0 fl oz
Fall Armyworm (larvae)	Flag leaf and panicle feeding reduces yield	Treat when larvae feeding on flag leaf or rice panicles	Sevin 80S, 80WSP Sevin 4L, 4F,XLR Karate Z Methyl parathion 4EC	1.25 to 1.87 lbs 2 - 3 pt 1.54 - 2.46 fl oz 1/2 to 1 pt
Greenbug (Aphid) (nymphs and adults)	Reduces stand and causes stunting	Treat when 2-3 greenbugs per 1-2 leaf rice or when plants become yellowed and stunted	Karate Z Methyl parathion 4EC	1.54 - 2.46 fl oz 1/2 to 1 pt

¹Labels are frequently changed, so always check the most recent label of any insecticide for directions and restrictions before application. Insecticides applied to heading rice have a pre-harvest interval. Be sure to know the pre-harvest interval before application.

Armyworm
[*Pseudaletia unipuncta* (Haworth)]

The adult is a moth with a wingspan of about 1 1/2 to 1 3/4 inches. The color of the forewings is tan with a single small white spot midway across the width and length of the wing. Hind wings are gray or gray-brown. Moths are active at night and lay eggs in large masses behind the leaf sheath of host plants. Armyworm adults are often transported with weather fronts

moving from the west and south into Arkansas. Adults are not known to lay eggs directly into rice.

Armyworm larvae (caterpillars) can be either green or brown but have a distinctive pattern of longitudinal stripes – a dark stripe along each side and a broad stripe along the back (dorsal stripe). The dorsal stripe has a lighter-colored broken line down the center. The head is pale brown with green and brown mottling.

Some armyworm larvae or pupae may survive Arkansas winters to emerge in the spring. Larvae often become numerous in wheat or oat fields before or shortly after heading. Large larvae sometimes leave the wheat fields and move into adjacent areas. If a rice field is adjacent, damage usually occurs near the border of the two crops and seldom is found over the entire field. Armyworms feed on leaves and stems and may consume all the above-ground rice seedling. The growing point is usually not damaged and seedlings normally recover; however, crop maturity can be delayed.

No formal scouting plan is used for armyworms in rice. Growers should observe rice fields next to wheat or oat fields that contain armyworms and watch for movement between the crops. Treatment is at grower discretion.

Insecticides available for control of armyworms are listed in Table 11-5. The timing between applications of herbicides containing propanil and organophosphate or carbamate insecticides is critical. Certain insecticides inhibit the action of an enzyme present in rice that prevents rice from being killed by grass herbicides. Thus, rice sprayed with propanil can be killed or severely injured if a carbamate or organophosphate insecticide follows or precedes propanil. The severity of damage depends on the time between the applications and the class of insecticide. A waiting period of seven days before or after propanil is recommended if an organophosphate insecticide (methyl parathion, malathion) is used. If a carbamate insecticide (i.e., Sevin) is used, a waiting period of 14 days before or after propanil is recommended. Problems with lethal interactions can be avoided by using Karate Z since it does not interact with herbicides. Pyrellin®, an insecticide with natural pyrethrins and rotenone, is also registered for use, but no data has been collected in Arkansas for efficacy against armyworms.

Aphids: Greenbug [*Schizaphis graminum* (Rondani)] and Bird Cherry-Oat Aphid [*Rhopalosiphum padi* (L.)]

Adults are small oval, soft-bodied insects with or without wings. Near the tip of the abdomen are two tube-like structures called cornicles. Two species, the greenbug and the bird cherry-oat aphid have been reported in rice. The greenbug has a pale green or yellowish-green body, pale green legs with dark tips, a dark green stripe down the center of the abdomen and pale green cornicles with black tips. The bird cherry-oat aphid has a purplish-green to dark purple body,

legs with black tips, cornicles with black tips and at the base of the cornicles is a reddish-orange spot across the bottom half of the abdomen.

The greenbug and bird cherry-oat aphids are common pests of wheat. The latter rarely cause economic damage to rice. Before 1996, greenbugs were an uncommon pest in rice fields. That year, greenbugs were often found feeding on rice and reduced stands in many fields. The bird cherry-oat aphid was first reported in rice in 1997. Each year since, fewer fields have been reported to be infested with these pests.

Aphids have piercing-sucking mouthparts and feed on plant liquids. The greenbug also injects a toxin into the plant while feeding. The toxin causes yellowing of leaves, and small plants may die with heavy feeding. Seedling rice plants with one to two leaves have been killed with only two to three greenbugs per plant. Larger plants with two or three greenbugs per plant may be stunted and turn yellow but have not been reported to die. The bird cherry-oat aphid does not inject a toxin while feeding, and stand loss has not been observed.

Thresholds are not available for treatment of aphids in rice. However, should greenbugs become numerous (two to three greenbugs per two-leaf or smaller rice), insecticide application may be beneficial. Karate Z and methyl parathion are recommended for control of aphids in rice (Table 11-5). Pyrellin®, with natural pyrethrins and rotenone, is also registered for use, but no data has been collected in Arkansas for efficacy against aphids.

Rice Stalk Borer [*Chilo plejadellus* Zincken]

The adult rice stalk borer is a moth with a wingspan of about 1 to 1 1/2 inches. The forewings are white or light brown with randomly placed very small black dots. Edges of each forewing have a row of very small metallic gold and black spots. Hind wings are white or light brown. Eggs are pearly white, flattened and laid in masses with eggs overlapping and resembling a pattern similar to fish scales. Larvae are light brown with one longitudinal dark brown stripe on the center of the back and one light brown stripe along each side of the body. Mature larvae have a length of 1 to 1 1/2 inches. Pupae are dark brown.

Moths emerge in May and lay eggs only in flooded rice. Eggs are placed in masses of 10 to 30 eggs on the top or bottom side of the leaf and sometimes behind the leaf sheath. Eggs hatch in five to six days. The small larvae from a single egg mass enter one or more rice plants by chewing a hole either behind the leaf sheath or near the base of the panicle. More than one larva

may enter the stem through a single hole. The larvae eat the inner stem tissue beginning at the entry point and move downward. Mature larvae chew through the tissues until only a single thin layer covers a circular hole in the stem wall above the water line. The adult escapes through the hole. Very seldom does more than one larva mature in a single stem.

Damage to the vascular stem tissue effectively stops translocation of nutrients. If the plant is infested anytime after permanent flooding but before heading, the main stem may die but not the tillers (called a dead heart). Likewise, if the larvae enter behind the leaf sheath of a tiller, the tiller may die but not the main stem. If the plant is infested just before emergence of the panicle, the green panicle emerges, but soon all the florets turn white (whitehead). Whiteheads are more numerous on edges of fields, paddy edges beside levees and on plants in the bar ditches. Fields bordered by weedy ditches or wooded areas often have higher infestations.

Larvae overwinter in rice stubble. Any method of stubble destruction such as plowing, rolling, burning or flooding should reduce the number of larvae that survive overwintering in the field. Fields that will be flooded for waterfowl habitat should have the rice stubble rolled, including stubble near and on the levees, to reduce overwinter sites. Rice varieties have different susceptibilities to the rice stalk borer. In small research plots, the varieties Bengal, Drew and Wells had very low numbers of whiteheads from stalk borer damage; Cypress, LaGrue and Cocodrie had higher numbers of whiteheads caused by the stalk borer. However, significant economic damage from rice stalk borer is seldom found in commercial rice fields. ICON 6.2FS seed treatment will reduce the number of whiteheads caused by rice stalk borer larvae (Table 11-5). Research studies have measured 40 to 70 percent reductions in the number of whiteheads where ICON-treated seed was used.

Some degree of biological control is provided by an egg parasite (*Trichogramma minutum*) that has been recovered from rice stalk borer eggs. A high degree of parasitism has been observed in small research plots, but no data is available on rates of parasitism in commercial fields.

Billbug [*Spenophorus* sp.]

The adult is a large black weevil 3/4 to 1 inch in length with a prominent snout. The legless larvae (grubs) have a white body and a reddish-brown head. Little is known about the billbug life cycle as it relates to rice. It is believed that the

female chews a small cavity near the base of the rice plant and deposits a single egg. The grub begins to feed on inner tissues of the stem about 2 inches above and below the soil surface. Larvae pupate in the plant stem. It is not known how many generations occur each season, nor if rice is the only host plant.

Billbug damaged plants turn brown and die. Damage appears similar to that of the rice stalk borer except the billbug causes damage only to unflooded rice plants. Grubs cannot survive if the base of the plant is submerged. Whiteheads occur on levees and in areas of fields where the flood is not maintained. No insecticides are currently registered for billbug control.

Rice Seed Midges [Family Chironomidae]

Adult midges resemble mosquitoes, but are smaller, and the mouthparts are underdeveloped. Larvae are light brown or red (bloodworms), legless, distinctly segmented and have a nonretractable head with opposable jaws. Mature larvae are very slender and range from 1/4 to 1 inch in length depending on the midge species. Several species have been found to damage rice.

Adult midges prefer to lay eggs on open water. Masses of eggs are laid in strings held together by a sticky mucus-like material that forms a protective envelope around the eggs. Eggs hatch in one to two days. The larvae use silk, bits of mud and debris to build tubes on the soil surface. Larval development is completed in seven to ten days. Pupation occurs underwater in the tubes. Adults emerge in two to three days.

Severe damage to rice is limited to germinating seeds, germinated seeds and very young seedlings in water-seeded rice with continuous or pinpoint flooding. Larvae feed by chewing on the developing seed embryo, root shoots and young seedlings. Larvae are often found inside the seed and in tubes built on the seed.

Water-seeded fields with continuous or pinpoint flooding should be checked for midge infestation and damage two to five days after seeding. Examine fields for midge larvae, tubes, damaged seed and damaged plants. Scouting should continue until plants are about 1 to 1 1/2 inches tall.

A field infested with rice seed midges can be drained to reduce midge populations and damage. Reflooding should occur only after the soil surface is dry. The number of viable seed or the number of established seedlings per square foot can be used to determine if a field should be drained or reseeded after thoroughly draining and drying

the soil. Other steps can be taken to reduce midge damage:

- Fields should be seeded as quickly as possible after establishment of the flood.
- Use pregerminated seed to hasten stand establishment.
- Avoid seeding during periods of cool weather because cool temperatures will delay rice growth but will not delay midge infestations.
- Use ICON 6.2FS treated seed to reduce rice seed midge larvae (Table 11-5).

Grasshoppers

Two general types of grasshoppers are commonly found in rice. The two types are short-horned and long-horned grasshoppers. The short-horned grasshoppers have antennae that are shorter than the body, a robust body that is usually brown or yellowish-brown and a large head with powerful jaws. Long-horned grasshoppers have a slender body that is green or yellowish-green and antennae that are as long as or longer than the body.

Short-horned Grasshoppers [Family Acrididae] – Short-horned grasshoppers are generally found near field margins and on levees. The differential grasshopper [*Melanoplus differentialis* (Thomas)] is the most common short-horned grasshopper known to damage rice. The large hind legs have a row of black chevrons. Adults (1 1/4 to 1 1/2 inches long) and nymphs have strong jaw muscles and are vegetation feeders. Rice leaves, stems and panicles are occasionally damaged, especially when food elsewhere becomes scarce.

Along the field or levee margins, short-horned grasshopper feeding may damage newly emerged panicles. The panicle stem may be damaged and result in a whitehead. Careful scouting of field borders can locate potentially damaging infestations. Spot treatment with an insecticide is at grower discretion and recommended whenever sufficient damage to panicles is evident. The insecticides Karate Z, Sevin, malathion, methyl parathion or PennCap-M are labeled for control of short-horned grasshoppers in rice (Table 11-5).

Long-horned Grasshoppers [Family Tettigoniidae] – The most common and abundant grasshoppers in rice are long-horned grasshoppers. The adults and nymphs have weak jaw muscles and cause only minor damage to rice foliage. Before panicle emergence, long-horned grasshoppers primarily feed on other insects, including the rice water weevil. After heading, these grasshoppers feed exclusively on pollen while flower anthers

are available. Adults are commonly found scavenging anthers on rice heads during flowering, but cause few, if any, blanks. After flowering, long-horned grasshoppers return to predator habits and, occasionally, feed on kernels in the milk stage. Insecticide application for long-horned grasshopper control is not recommended.

Fall Armyworm [*Spodoptera frugiperda* (J.E. Smith)]

Larvae (caterpillars) have a range of colors from tan to brown to green and are about 1 1/2 inch in length when fully grown. Larvae have three yellowish-white hairlike stripes on the back, an inverted “Y” on the head and prominent black fleshy projections on the body. Fall armyworm larvae do not appear in rice fields every year. If larvae do appear, it is usually during late July and early August. Larvae are normally foliage feeders but can occasionally be found on rice panicles. Treatment with insecticide may be considered if larvae are feeding on the flag leaf, stem or panicles. Feeding on leaves, other than the flag leaf, is not as important and treatment may not be necessary. The insecticides Sevin, Karate Z and methyl parathion can be used for control of fall armyworm larvae (Table 11-5).

Chinch Bug [*Blissus leucopterus leucopterus* (Say)]

Adults are about 1/8 inch long, black and have wings folded onto their back that appear like a white “X.” The first instar nymph is orange and the other four instars have a black or dark gray head and thorax with a white or yellow band across the top of the abdomen. Both adults and nymphs have piercing-sucking mouthparts. Damaged leaves appear stippled white among the green while moderately damaged leaves are yellowed. Seedling rice plants are the most susceptible to damage. Severely damaged seedlings turn brown and die. Chinch bugs are relatively small, so examine inside whorled leaves, behind the leaf sheath, at the base of the stem and, if the soil is cracked, examine exposed roots. Recent data from Texas suggests that an average of one chinch bug per seedling can cause significant seedling mortality, reduction in height and delay in maturity of surviving plants. Therefore, if chinch bug populations average one adult per plant, insecticide application is recommended. Sevin and Karate Z are labeled for chinch bug control. Flushing or flooding will move chinch bugs above the water line and contact insecticides will be more effective. ICON 6.2FS seed treatment will also effectively reduce chinch bug damage and prevent stand loss (Table 11-5).