

Rice Research News

Rice Research and Extension Center • University of Arkansas Division of Agriculture

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From the Director

New facility dedication April 15

A dedication program for the new Rice Research and Extension Center facility is being planned for April 15. We moved into our new offices and laboratories in mid-January. Soon after, we hosted the first meeting in our spacious, new auditorium, which is named the "Arkansas Rice Farmers Conference Center," in recognition of the contribution they made towards funding construction. Appropriately, it was a Crop Production meeting put on for farmers. I like that the room name uses the word "farmer," a word some have shied away from using in favor of "producer" or "grower." Farming is an ancient and proud profession, and we're proud to use the word.



Christopher W. Deren

Neck blast a major problem in wet 2009 growing season

The 2009 rice growing season in Arkansas was wet, to say the least. How wet was it? According to the National Weather Service in North Little Rock, it was the wettest year on record for many reporting stations in the state (Fig 1).

And, oddly enough, July was the fourth wettest month, with 11 or more inches of rain, when 3-4 inches is normal. Not only did it rain a lot, but the days of rainfall during July in the Grand Prairie rice growing region were impressive, with 19 of 31 days having measurable precipitation at a rice testing site in Lonoke County (Fig 2). July is a critical month in the state for disease development, as much of the rice crop is reaching the booting stage, a sensitive time for potential damage.

rice acreage in 2009 was planted to varieties rated susceptible to highly susceptible to neck blast disease, and about 20% of the crop was planted after May 27, and late planting increases the likelihood of blast damage.

And these susceptible varieties were often planted in fields that tended to favor blast, that is, sandier fields with problems holding a 4-inch or deeper flood consistently during the growing season. Our research in the early 1990s showed an aerated soil root zone environment is as criti-

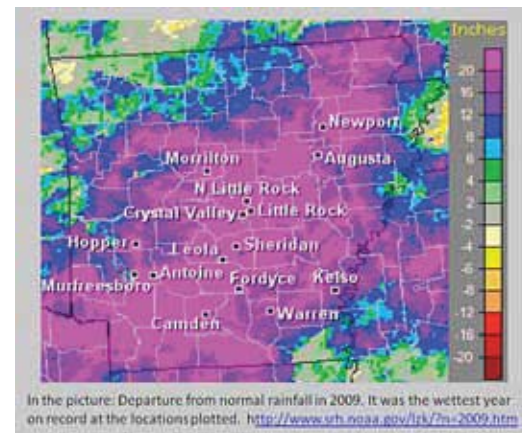
Free water favors rice blast development

Rice blast disease is caused by a fungus which needs about ten or more hours of free water on the leaf surface for airborne spores to germinate and infect plants. Wet foliage was not a problem to find during July in 2009. Therefore, the blast fungus had no problem building up in the crop.

To make matters worse, about 50% of our

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Click here:
<http://aaes.uark.edu/rice.html>

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In the picture: Departure from normal rainfall in 2009. It was the wettest year on record at the locations plotted. <http://www.srh.noaa.gov/lrk/2n-2009.htm>

Fig. 1. Rainfall Map for Arkansas 2009

Neck blast ...

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cal for blast infection and development as the wet leaf — and that deeper, consistent flood depths minimized blast disease across all varieties. Certain blast susceptible varieties actually become blast resistant when the flood and fertility are properly managed. The Extension service has tested and recommended these practices since 1996 as an aid to managing rice blast disease in the state.

The combined result of the weather pattern, late planting, and use of susceptible varieties in blast prone fields was the worst neck blast epidemic in Arkansas since the Newbonnet blast years of 1986–1987. An example of the level of damage is shown in Fig. 3, a field of Francis rice with 100% neck blast incidence, resulting in a yield of only 62 bushels per acre, despite having been sprayed twice with high rates of fungicide.

Affected counties and varieties

We inspected 52 very heavily damaged fields in 10 counties (Fig. 4, dark red) and another 18 with moderately severe damage in six other counties (Fig. 4, pink). Many other fields of susceptible varieties in these areas had noticeable blast disease as well, but many also had major damage prevented by growers that were able to intervene in time to manage the disease.

Of the 52 severely damaged fields we inspected, 20 were CL 151 (rated very susceptible to blast); 17 were planted to Francis (very susceptible); 11 to Jupiter (susceptible) and 4 to Wells (susceptible). Of the 18 fields with moderately severe damage in the other ten counties, 7 were CL 151; 5 were Francis; 4 were Jupiter; and 2 were Wells. We also observed some damage in fields of Bengal and Cheniere in the region. In every field with severe damage, there were problems with flood depth, at least with regard to managing blast disease. To minimize blast, fields should be flooded to a 4-inch minimum depth (shallowest part of the paddy) and this depth held consistently throughout the growing season. In damaged fields, growers often turned off the pumps to save fuel or electricity costs, since it was raining all the time anyway. The result was erratic or shallow flood depth and wet plants all the time from rainfall, the worst of both worlds for blast disease.

Early warning

In early July, the University of Arkansas Division of Agriculture Cooperative Extension Service county agents started putting the word out about the potential for blast disease in the state, and many growers responded by pumping the flood up on susceptible fields and preparing to spray properly. These efforts did control blast in many situations, so the statewide epidemic could have been much worse, perhaps even rivaling that of the Newbonnet days. As an illustration, in one county, a Jupiter field managed with deeper flood and two well-timed fungicide applications yielded 201 bu per acre, while nearby (Jupiter) fields with erratic flood depth, and a single shot of fungicide yielded less than 120 bu per acre.

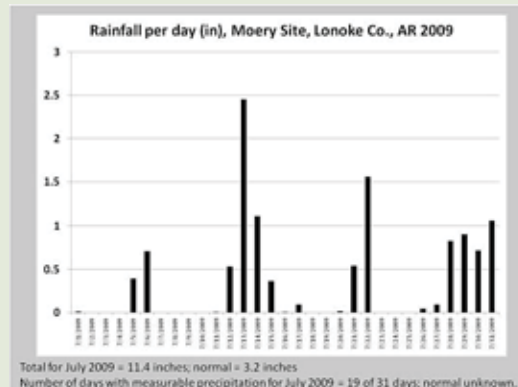


Fig. 2. Daily rainfall for Lonoke Co. test site



Fig. 3. Francis rice field, heavily damaged by neck blast



Fig. 4. Arkansas counties with noted blast damage

Neck blast ...

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Fungicides

Our modern rice fungicides are much better than what we had in the 1980s, but they have limits, especially when it is raining all the time. In “normal” summers, when July is a dry month, management of blast is not as difficult, and often we can “get by” with one fungicide application, or lower rates, or even improper timing because disease pressure is light anyway. But July of 2009 was not the type of month when partial fungicide measures were going to work well. When it is raining consistently, and growers have late planted fields of susceptible varieties with erratic flood depths, fungicide timing and rates have to be more precise for maximum effectiveness.

Fungicide timing is critical

The labels on Quadris™ and Gem™ fungicides, as well as Stratego™ and Quilt™, clearly spell out the proper timing and rates we have researched over the years under severe disease conditions like last summer, but sometimes a picture is worth a thousand words. So, Fig. 5 shows the proper timing for the first application of fungicide to prevent neck blast disease in rice, and Fig. 6 shows the timing for the second application. In 2009, on the fields we described above, fields needed two applications timed properly to do the best, and even then, results might not have been perfect, but were much better than doing nothing or applying one or two shots at the wrong timing and getting no results.

In general, what we heard from growers of the affected fields was that either no fungicide was applied, or they applied a single shot during booting for sheath blight, or they did not start spraying for blast until they saw damage on the heads. Once neck blast lesions can be seen or the base of the panicle is out of the boot, it is too late for the fungicides to do their best — they are strictly preventative and have to be applied before the fungus gets into the neck or panicle, which often happens as the head emerges completely from the boot. In the case of fields with erratic head emergence, county agents and consultants made a judgment call, doing their best to treat the majority of the field at the proper time. In some cases in 2009, they even split fields, treating the earlier emerging half at one time and the later emerging part of the field a bit afterward, to try and get fungicide on plants at the right stage. Regardless, in many cases, we were able to prevent major blast damage by pumping up the field and holding a deeper flood, combined with proper fungicide usage.

Using resistant varieties

As previously mentioned, we plant half our acres in blast susceptible varieties. Why? Because many of the highest yielding varieties available are also susceptible to blast. While yield is the most important trait, high yield alone does not make a good variety. Under our conditions, developing and planting varieties with high yield and manageable disease resistance is essential,



Fig. 5. Rice growth stage for first fungicide application to prevent neck blast



Fig. 6. Rice growth stage for second fungicide application to prevent neck blast.

and 2009 reminded us about that balance in what we grow. CL 151 and Francis, with the highest risk for blast damage, are great varieties when planted in wide open, flat fields with excellent water management and no strong history of blast, but they are a terrible choice for sandy fields, furrow irrigation or other systems that strongly favor this disease. While expensive, current hybrid rice varieties are the best choice for fields with a strong history of blast, or rice production systems that favor neck blast, because hybrids have high yield potential combined with very good disease resistance. A good future choice for very blast-prone systems would also be the recently released variety from the Arkansas breeding program, called Templeton, that has good

Neck blast ...

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yield potential and very strong blast resistance. For medium grains, Jupiter has resistance to bacterial panicle blight so it is a stronger choice than Bengal or Neptune for most fields in Arkansas most years, but the new medium grain variety Neptune would be a better choice in blast situations because it is more resistant to that disease. The right balance of good traits in future rice varieties is just common sense.

While resistant varieties are an important fundamental in growing the best rice crop possible, it is also true that resistance to blast may not hold up forever in a given variety, especially if planted repeatedly in systems that are extremely favorable for this disease. Consistent production of rice on sandier soils, under intermittent flooding, or using furrow or pivot irrigation likely means that the highly adaptable blast fungus will eventually develop new races that quickly overcome the resistance currently in hybrid rice, Templeton or other resistant varieties. Thus, growers using these systems or having fields with blast history should continually monitor these fields for rice blast and are seriously

asked to help us monitor the blast fungus over time. So if rice blast lesions are observed on leaves, collars or necks of resistant rice varieties or hybrids, please contact the local county extension agent so that we can collect samples and try to stay in front of the fungus as it changes. New blast races quickly develop within a single year or two but several years are required for us to locate and move resistance genes into highly productive rice varieties.

Hurt but could have been worse

While 2009 was pretty tough, as disease challenges go, conditions last year also showed us how good our technology is and how good our farmers, county agents and consultants are at responding and managing problems. The result overall was a good crop statewide, despite the weather. While blast put a dent in us, it could have been a lot worse. Nevertheless, here's hoping for an easier rice season in 2010.

Rick Cartwright, Professor and Extension Plant Pathologist
UA Fayetteville

Fleet Lee, Professor of Plant Pathology
RREC

New high-yielding rice variety, 'Roy J,' highly resistant to lodging

The University of Arkansas Division of Agriculture has released a new high-yielding, long-grain rice variety, 'Roy J,' which is named in honor of the late Roy J. Smith, who was a weed scientist with the USDA Agricultural Research Service based at the Rice Research and Extension Center for many years.

Chuck Wilson, Cooperative Extension Service rice agronomist, said the straw strength of Roy J "is the best I have ever seen." Wilson added that, "In three years of testing, I have only seen one or two plots lodge. This is in spite of two hurricanes we had in 2008."

The new variety also has excellent yield potential and good milling yield. The disease reaction is similar to 'Wells,' which is manageable, Wilson said.

Foundation Seed of Roy J was grown at the Rice Research and Extension Center (RREC) in 2009 for sale to seed growers for the production of Registered Seed.

The following description of Roy J was provided by its developer, rice breeder Karen Moldenhauer, professor of crop, soil, and environmental sciences and holder of the Rice Industry Chair for Variety Development, based at RREC.

Roy J was developed as breeding line RU0801076. It is a very high yielding, mid-season, long-grain rice cultivar developed by the Arkansas Agricultural Experiment Station. It originated from the cross LaGrue'/'Katy'/'Starbonnet'/'5'/'Newbonnet'/'Katy'/'RA73'/'Lemont'/'4'/'Lebonnet'/'9902'/'3'/'Dawn'/'9695'/'Starbonnet (cross no. 20001692), made at the RREC in 2000.

Roy J is a standard height, long grain rice cultivar similar to Wells in appearance with high yield potential and very good

lodging resistance. Roy J is similar in maturity to 'Drew.' It has better straw strength than 'Francis' or 'Wells,' which is an indicator of lodging resistance. On a relative straw strength scale (0 = very strong straw, 9 = very weak straw) Roy J, Francis, Wells, LaGrue, Drew, 'Cybonnet' and 'Cocodrie' rated 2, 4, 3, 5, 6, 2, and 2, respectively. 'Roy J' is 43 inches in plant height, which is similar to Wells.

Yields of 'Roy J' have consistently ranked among the highest in the Arkansas Rice Performance Trials (ARPT). In 12 ARPT tests (2007-2009), Roy J, Taggart, Francis, Wells, Cybonnet, Cocodrie and Drew averaged yields of 192, 179, 179, 178, 157, 153, and 159 bu/a at 12% moisture, respectively. The Uniform Regional Rice Nursery (URRN) conducted at Arkansas, Louisiana, Mississippi, Missouri and Texas during 2008-2009 provided additional data on yield and milling. Roy J had an average grain yield of 207 bu/a which compared favorably with those of Taggart, Francis, Wells, Cybonnet and Cocodrie, at 214, 190, 196, 188 and 193 bu/a, respectively. Milling yields (percent whole kernel:percent total milled rice) at 12% moisture from the ARPT, 2007-2009, averaged 59:71, 58:72, 61:71, 55:72, 57:70, 64:72, 64:71 and 59:71, for Roy J, Taggart, Francis, Wells, LaGrue, Cybonnet, Cocodrie and Drew, respectively. Milling yields for the URRN during the same period of time, 2008-2009 (without Missouri in 2008), averaged 58:72, 57:72, 59:71, 59:72, 65:73, and 63:72, for Roy J, Taggart, Francis, Wells, Cybonnet and Cocodrie, respectively.

Roy J, like Francis, Wells and LaGrue, is susceptible to common races of rice blast when grown under Arkansas



Breeder head row seed plots of breeding line RU0801076, which has been released as the new variety, 'Roy J,' which were planted April 8, 2000, are pictured on Nov. 19, 2000, at the Rice Research and Extension Center.

New high-yielding rice variety, 'Roy J,' ...

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conditions. Roy J is rated MS to sheath blight which compares with Francis (MS), Wells (S), LaGrue (MS), Cybonnet (VS), Cocodrie (S), and Drew (MS), using the standard disease ratings of R = resistant, MR = moderately resistant, MS = moderately susceptible, S = susceptible and VS = very susceptible to disease. Roy J is rated S for kernel smut which compares to Francis (VS), Wells (S), LaGrue (VS), Cybonnet (S), Cocodrie (S) and Drew (MS). Roy J is rated S to stem rot, R to brown spot, MR to narrow brown leaf spot, S to false smut, and MS to crown (black) sheath rot. Roy J is rated susceptible to bacterial panicle blight. It has a susceptible reaction to straighthead and should be drained on the straighthead soils. Under high nitrogen fertilization, Roy J is susceptible to kernel smut and false smut.

Plants of Roy J have erect culms, dark green erect leaves, and smooth, non-hairy lemma, palea, and leaf blades. The lemma and palea are straw colored with red and purple apiculi, many of which fade to straw at maturity. Roy J is partially awned with long awns on the lemma when grown under high fertility. Kernels of Roy J are similar in size to Cybonnet. Individual milled kernel weights of Roy J, Taggart, Francis, Wells, LaGrue, Cybonnet, Cocodrie, and Drew averaged 18.3, 20.2, 17.3, 18.9, 17.8, 17.7, 17.8, and 15.9, respectively, in the ARPT, 2007-2009.

The endosperm of Roy J is nonglutinous, nonaromatic, and covered by a light brown pericarp. Rice quality parameters indicate that Roy J has typical southern U.S. long-grain rice cooking quality characteristics as described by Webb et al. 1985. Roy J has an average apparent starch amylose content of 22.4 g kg⁻¹ and an intermediate gelatinization temperature (70 - 75°C), as indicated by an average alkali (17 g kg⁻¹ KOH) spreading reaction of 3 to 5.

The foundation seed field of Roy J was rogued several times throughout the season. The variants that may be found in the release include any combination of the following: taller, shorter, earlier, later, glabrous or pubescent plants, plants that are fully awned, as well as intermediate or very-long slender grains. Other atypical plants may still be encountered in the variety. The total variants and/or off-types numbered less than 1 per 5000 plants.

Breeder and foundation seed of Roy J will be maintained by the University of Arkansas Division of Agriculture's Rice Research and Extension Center, P.O. 2900, Hwy 130 E., Stuttgart, AR 72160. Plans are being made to apply for PVP and a utility patent for the Roy J cultivar.

Karen Moldenhauer, Rice Breeder, RREC
Professor of Crop, Soil, and Environmental Sciences
and Rice Industry Chair for Variety Development

Stay-green trait associated with gain yield and milling quality

High field grain yield and acceptable milling quality are very important objectives of our rice breeding program. We are constantly investigating traits in our new cultivars that will maintain and improve both of these objectives. One such trait can be characterized by a rice plant having dark green leaves and delayed leaf drying at grain maturity, and is known as stay-green.

The stay-green trait was observed in Colombia in the 1950s and is thought to be responsible for higher amounts of chlorophyll in the leaves, which provides higher rates of photosynthesis, and the photosynthesis rates continue to remain high through grain filling. Plants lacking stay-green tend to begin leaf drying before or during grain filling, which is thought to decrease the duration and quality of grain filling.

When the leaf is young, it builds up nutrients and other materials that are transported to the growing parts of the plant during growth. Leaves turn yellow during aging because of the degradation of chlorophylls and proteins that are acquired during photosynthesis. In theory, the longer photosynthesis continues, the longer the plant stays green, and the longer the grains will fill. This is how the term “stay-green” came about.

Photosynthesis rates can be measured digitally by use of a SPAD meter, which reads the amount of chlorophyll in a leaf. The higher the SPAD reading, the more chlorophyll in the leaf. We measured leaf chlorophyll content of two rice lines that were observed to be different in shade of green color in the field. We also made a cross between these plants and measured chlorophyll in the leaves of their progeny to see how this trait is inherited.

Knowing how the trait is inherited will help rice breeders in their selection methods. Breeders will know what ratios to

expect in progenies and can predict the gene action taking place. The phenotypic ratios shown in all of the populations from the cross were representative of single dominant gene inheritance. More confident crosses can be made involving this trait that will perhaps lead to more stay-green rice varieties with higher yields and better grain quality.

James Gibbons, Rice Breeder
Assistant Professor of Crop, Soil, and Environmental Sciences

Jerry D. Morgan, Graduate Assistant



Figure 2. Using the SPAD meter to measure leaf chlorophyll content.



Figure 1. Stay-green and non-stay-green plants in the field.



Figure 3. Color variation in panicle rows of the cross 030459.

New insecticides available for rice stink bug control

Rice lines have different levels of susceptibility to organisms that discolor kernels. In the field, kernel discolorations are caused by fungi alone, such as kernel smut or by fungi introduced by the rice stink bug and by physiological responses to adverse environmental conditions during grain fill. Agents that discolor rice kernels are commonly found in all Arkansas rice fields, but the majority of discolored kernels are a result of feeding by rice stink bug adults and nymphs (Figure 1). Stink bugs can feed on rice kernels at all stages of kernel development except at hard dough and maturity. Feeding during the early stages of kernel development prevents grain fill and results in light-weight immature kernels. Feeding during the later stages of development often results in only a portion of the contents being removed (Figure 2). But after the hull of any stage kernel is pierced by rice stink bugs, fungi gain entry and the infection results in a discoloration of the kernel (Figure 3). The amount of damage by rice stink bugs often influences the acceptability and value of rough rice. Such was the case in 2001 and 2002 when rice fields were highly infested with rice stink bugs. Grain inspections by rice buyers during those years found unusually high levels of discolored kernels that decreased the value of grain by as much as \$0.25 per bushel.

The entomology research program places emphasis on the development of control strategies that integrate control methods such as less susceptible rice lines, insecticides and rice stink bug parasites. A portion of the program evaluates insecticides for contact and residual control of rice stink bugs. The overall objective is to provide information to the chemical industry on the efficacy of candidate insecticides. A product that gives excellent contact control plus an extended residual control is sorely needed in rice. This article is a summary of a field test investigating the use of the insecticides dinotefuran (Tenchu®) and clothianidin (Belay®) for control of rice stink bug.

Nylon tulle sleeve cages were used to confine adults on rice panicles. Some cages were placed over panicles before insecticides were applied to field plots; while others were placed over panicles at 1, 2, 3, 5, 7 and 10 days after treatments were applied to test for residual activity. Treatments were an untreated check, the standard KarateZ® (lambda cyhalothrin) at 0.03 lb ai/acre, Tenchu® (dinotefuran) at 0.066 and 0.132 lb ai/acre, and Belay® (clothianidin) at 0.093, 0.145 and 0.180 lb ai/acre. Cages remained in the field for three days. After the 3-day exposure time, plants were cut below the cage, taken to the laboratory, and number of dead bugs counted.

All three insecticides had excellent contact mortalities of rice stink bug adults (Table 1). Mortalities of bugs placed on panicles one day after applications were also excellent. This was truly a surprise that bugs had any mortality the next day after foliar treatment with KarateZ. Usually with KarateZ observed mortalities one day after treatment have been between 0 and 20%. Even more surprising was mortalities of caged rice stink bugs also occurred on days 2 through 7 in the KarateZ treatment. The results in this test with KarateZ have never been observed in any other similar type test.



Figure 1. Rice stink bug adult.



Figure 2. Examples of kernels where feeding as removed the contents and fungal infection has caused some discoloration.



Figure 3. Examples of kernels where fungal infection has caused surface and internal damage and discoloration.

*(Continued from page 8)***Table 1. The average percent mortality of rice stink bug adults caged over rice panicles sprayed with three insecticides, RREC, 2008.**

Treatment	Rate	Percent Mortality						
		Days after Treatment when Cages Placed over Panicles						
		0 ^x	1	2	3	5	7	10
Untreated	-	0	0	0	0	0	0	0
KarateZ	0.03	100	89	75	50	75	25	0
Belay	0.093	100	100	0	100	100	50	0
Belay	0.145	100	100	75	75	50	25	0
Belay	0.180	100	100	75	75	100	50	0
Tenchu	0.066	100	100	50	50	50	25	25
Tenchu	0.132	100	100	50	100	100	100	25

^x cages placed before insecticide application, thus giving a rating for contact mortality.

Cages placed over treated foliage on days 2 through 10 showed the residual activity of Tenchu, Belay and the unexpected activity of KarateZ. As stated earlier, previous tests with KarateZ had minimal activity after 24 hours, but those tests had no rainfall and only sunny hot days. During this test rain fell on the plots on the third, fifth and seventh days of the test. It is unknown what effect the rain had on this test, although it is generally thought that rainfall after application has a negative influence on the performance of insecticides. Both Tenchu and Belay have demonstrated high residual activity in Texas, so these results were expected. Perhaps the residual activity could have been longer if there were no rain. As can be seen in Table 1, Tenchu had a slightly longer time of residual activity than that of Belay.

Application of insecticides to control rice stink bugs are to prevent or reduce the amount of damage to rice kernels (pecky rice). These insecticides were applied ten days after 50% head-

ing, and this single application reduced the amount of pecky rice in treated rice by about 50% of that found in the untreated plots.

The rice stink bug is one of the important pests commonly found in Arkansas rice fields. When outbreaks in fields reach critical levels, an insecticide application is an option. Pyrethroid and organophosphate insecticides usually give excellent contact mortality, but both groups lack any significant residual activity. The two new insecticides, Tenchu and Belay, had excellent contact mortality and significantly better residual activity than historically provided from the commonly used pyrethroid and organophosphate insecticides. The residual activity decreased somewhat at the end of 7 days for Belay and at the end of 10 days for Tenchu. Registration of both insecticides is encouraged by researchers and being pursued by the chemical companies.

This research is supported by the Arkansas Rice Research and Promotion Board and by Mitsui Chemical Co. (Tenchu), Valent USA (Belay) and Syngenta Crop Protection (KarateZ).

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