RICE INFORMATION

UofA DIVISION OF AGRICULTURE RESEARCH & EXTENSION University of Arkansas System

Reviewing the 2016 Arkansas Rice Season

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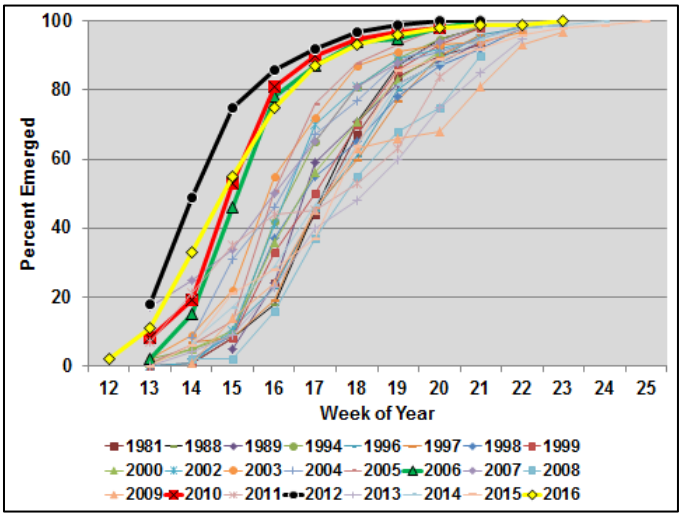
Planting and Progress

The 2016 rice season began extremely early as producers started planting as early as March 7th. From there, a surprising number finished planting by April 1 and many more in the early part of April – in **Figure 1**, Week 15 is equivalent to April 15th. For historical perspective, planting progress trailed behind only 2012 and 2010 and was similar to 2006.

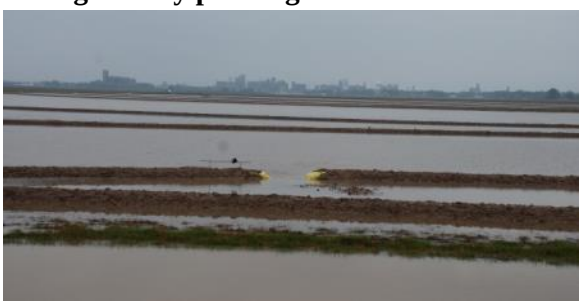
Conditions during these early weeks could be considered adequate for planting rice but soil temperatures were still relatively low and the number of days to emergence was prolonged. For example, March 22 planted rice at Stuttgart did not emerge for 21 days compared to rice planted April 5 (12 days to emerge) and April 23 (8 days to emerge).

While conditions were dry and favorable for planting early, heavy rains did occur in areas beginning in late April and early May. These rains led to standing water and flooded conditions on newly planted rice, some resulting in replant situations. Most field situations were able to have standing water removed in 10 days or less which minimized the stand losses and subsequent replanting of rice.

Fig. 1. Historical planting progress by week of year, 1981-2016 (USDA-NASS).



Picture 1. Late March rain of 4-7" in areas damaged early plantings.



Picture 2. Stands were improved by some rains that arrived 'better late than never'.

Picture 3. Seedling difficulty emerging from crusting soils.

Picture 4. Early-season herbicide drift from burndown applications slowed progress.

Picture 5. Early May brought ideal weather and temperatures.

Picture 6. Fertilizing and flooding of rice fields began earlier than usual.

When planting was complete, Arkansas growers planted 1.55 million acres of rice. However, after flooding issues in the north only 1.52 million acres are expected to be harvested (**Figure 2**). Of that, 1,390,000 acres are long grain and 130,000 acres are medium grain. Of the total acreage planted, CLXL745, Roy J, XL753, CL151, LaKast, and Jupiter were the most widely planted cultivars in the state (**Table 1**). Acres planted to Clearfield rice (**Figure 3**) and hybrid rice (**Figure 4**) increased slightly from 2015 levels.

Figure 2. Arkansas Harvested Rice Acreage Summary, 1976-2016 (USDA-NASS).

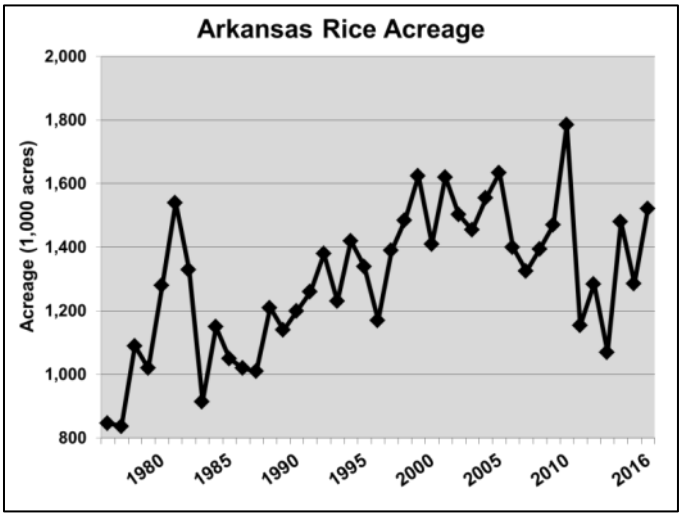


Table 1. Summary of Arkansas Rice Cultivar Distribution, 2011-2016.

Cultivar	2010	2011	2012	2013	2014	2015	2016*
	% of Acres						
CLXL745	19.5	29.4	28.4	22.3	22.0	19.9	21.3
Roy J	0.1	2.1	6.3	13.8	12.6	13.1	19.6
XL753	--	--	--	6.2	11.8	14.5	13.6
CL151	22.5	12.4	13.1	9.7	12.6	12.4	12.1
LaKast	--	--	--	--	--	5.0	8.1
Jupiter	8.7	13.4	7.6	9.9	13.0	14.4	6.6
CLXL729	6.5	7.0	11.4	7.4	4.2	3.2	4.1
CL111	1.3	3.0	4.1	6.0	5.0	3.8	2.1
Mermentau	--	--	--	1.0	4.9	4.1	1.3
Taggart	0.5	0.7	2.1	1.0	1.2	0.5	1.0
CL163	--	--	--	--	--	0.1	0.7
XL723	1.5	3.1	9.8	3.4	1.1	0.9	0.7
Wells	15.0	6.5	6.1	3.1	2.9	1.6	0.7
Francis	6.0	1.7	3.7	1.9	1.3	0.7	0.5

Figure 3. Percent of Clearfield Rice Acres in Arkansas, 2001-2016.

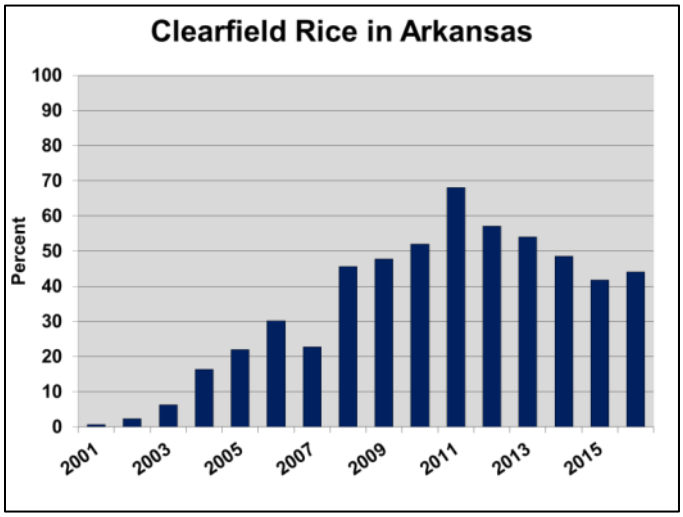
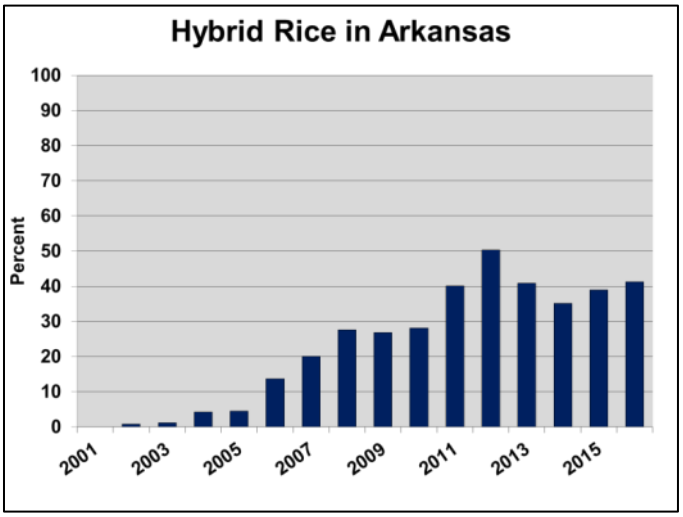


Figure 4. Percent of Hybrid Rice Acres in Arkansas, 2001-2016.



Early Season Issues

With the early planting, many fields were already being fertilized and the permanent flood established in early May. Given the wet soil conditions, many had to make choices about applying nitrogen on dry soil, muddy soil, or in standing water. Additional rains followed throughout the month of May that continued to make fertilizing a balancing act. Many were still able to fertilize on dry soil as recommended, but the rains did complicate the issue.

The use of insecticide seed treatments such as CruiserMaxx Rice and NipsIt INSIDE has increased dramatically over the past several years. Unfortunately in 2016, it appeared that the economic conditions led to some reduction in their use, or there was confusion as to whether the seed was treated or not. In a number of cases seed was thought to be treated and was not, or the seed had been in the ground for 45+ days, resulting in an increase in reports of injury from Grape Colaspis and Rice Water Weevil this year.

Picture 7. Grape colaspis injury to rice with no insecticide seed treatment.

Picture 8. "Bean row effect" from Grape Colaspis with no insecticide seed treatment.

Fall armyworm did not live up to its name and showed up well ahead of the fall. In mid-July they began showing up in various rice fields. In some cases feeding and damage was minimal and didn't require treatment. In other fields they began feeding directly on kernels and cutting flag leaves and treatment was necessary.

In further cost-saving attempts growers reduced preplant fertilizer inputs. As a direct result, there seemed to be an uptick in the number of fields displaying zinc deficiencies soon after flooding and potassium deficiencies soon after midseason. There are few shortcuts available to replace proper soil testing and fertilization – a reality many were reminded of with sick rice to cure.

Early season deficiency-like symptoms were also observed where compaction was an issue from early soil preparation – typically from land leveling. This resulted in some increased herbicide injury as well as temporary deficiency symptoms where fertility was adequate. Once sunny and warmer conditions arrived plants began to outgrow these problems.

Picture 9. Fall armyworm feeding on a developing rice panicle.

Picture 10. Zinc deficiency post-flood.

In additional attempts to save on input costs, an increasing number of producers were trying furrow irrigated rice (also called row rice or upland rice) for the first time. While this practice has some promise it

creates an entirely different set of management issues. Weed control, proper irrigation, and fertility were the biggest hurdles, but a number of strange occurrences showed up such as salt injury.

Picture 11. Salt wicking to the top of beds to injure and kill seedlings in row rice.

Weed control was largely successful in 2016. Producers used a wide variety of overlapping residuals as recommended and the results showed with weed-free fields late in the season. There were problems managing some herbicide resistance in the sedges and some grasses, but most efforts were met with success.

In some instances herbicides worked a little too well and Delayed Phytotoxicity Syndrome (DPS) was noted. Most often it was isolated to small areas of fields that outgrew the issue and only a few fields needed to have the flood lowered to address the problem.

Picture 12. Various distorted rice plant features due to DPS.

Hydrogen sulfide toxicity reports have been increasing in recent years. Debate continues as to whether this disorder is increasing in frequency or in our understanding and identification of it. At any rate, issues have been quite severe from it at times. When this occurs, the field must be drained to allow oxygen to return to the roots for normal rice growth to continue. During an extremely dry summer like 2016, this was increasingly problematic as growers could easily fall behind in irrigation management if forced to drain fields under the hot and dry conditions.

Picture 13. Hydrogen sulfide toxicity causing severe injury (right) compared to rice on the levee (left).

Late Season Issues

Disease concerns were minimal throughout the majority of the year due to the dry conditions throughout the season. However, an extended period of rain during mid-August led to a sharp increase in late-season bacterial panicle blight, blast, and sheath blight incidence. Susceptible cultivars such as Roy J and CL151 were affected by late neck and panicle blast

infections. In a few instances, even the node within the flag leaf sheath was affected.

Picture 14. Bacterial panicle blight in random panicles of susceptible cultivars.

One additional oddity of the year was the late development of kernel smut and false smut – this was across all cultivars and could be noted whether fungicides had been applied or not. This was primarily attributed to environmental conditions which were extremely favorable to their development such as prolonged warm, wet weather during late pollination and grain fill for kernel smut and the continuous rain for false smut.

It should also be noted that some instances of blast were in fact not blast. Weak pathogens such as species of *Curvularia* were found to be infecting rice necks and panicles. This is particularly strange and reflective of the odd August heat and rain. *Curvularia* spp. typically only show up on the exterior of grains late in the season after rice has matured in the field for some time along with other pathogens such as *Fusarium* spp. and *Alternaria* spp.

Picture 15. Rotten neck and panicle blast in a susceptible cultivar with no preventative fungicide application.

Rice stink bug pressure was elevated throughout the year. During and after rice was being drained, stink bug pressure remained far higher than typically seen. Stink bug levels well over threshold were recorded and treatment necessary at times late enough to cause issues with pre-harvest intervals required by the insecticide labels. As a result of sprouting and late-season insect pressure, the percentage of damaged kernels increased compared to previous years.

Picture 16. Rice stink bug feeding on soft dough kernels in draining rice.

The extended period of rainfall during August also caused sprouting of near-mature grain on standing rice. This phenomenon, present across the state, has not been noted since the late 1970s. In areas where the rainfall was most persistent and severe, sprouting was extreme in places. Overall, across the state it was more common to see minimal sprouting of only a few kernels per panicle. This has had the impact of reduced milling yields, further limiting returns amid already low commodity prices.

The period of rainfall that led to the significant sprouting also caused excessive flooding. Randolph, Lawrence, Clay, and Craighead Counties combined to have approximately 40,000 acres of rice directly affected by floodwater resulting from heavy rains. Roughly 20,000 of those acres were completely submerged. Depending on timing of flooding and duration of submergence, some fields were complete losses while others suffered moderate to severe losses.

Picture 17. Sprouting rice kernels on standing rice.

Picture 18. Various stages of sprouting rice kernels from standing rice.

Picture 19. Rice seedling from a sprouting kernel rooting down on a nearby flag leaf.

Picture 20. Flooded field with rice underwater and slightly higher elevation field behind.

Major Effects of Daytime and Nighttime Temperature on Yield & Quality

After the rainfall throughout late April and May, there was a prolonged dry spell through June and July. For many in the Delta, from June 1 to August 1 there was little or no measurable rainfall. As we moved into July, irregular, scattered pop-up showers and windy conditions became common during heading. This isn't always a problem this time of year, but the time of day they occurred – the majority during mid-day and early afternoon – is a time when rice is flowering and susceptible to pollination issues resulting from the sudden downpours.

Picture 21. Environmental damage to kernels – likely due to daytime winds.

Picture 22. More wind damaged kernels – NOT bacterial panicle blight.

Late July and early August brought the most concerning issue of the year – high daytime and nighttime temperatures. Immediate concerns turned more toward the nighttime temperatures and the possibility that they may reduce rice quality by increasing chalky kernels – which did occur. The daytime temperatures were not that extreme or that different from those seen in the past. However, the nighttime temperatures, both the level and the timing, were an issue to an extent rarely seen before.

Yield reports for 2016 have been off from 0-20 bushels per acre for hybrids and 20-40+ bushels per acre for varieties. The issue was clearly a decrease in successful pollination of kernels from a combination of high nighttime temperatures affecting successful pollination and thunderstorms damaging florets to disrupt pollination.

When temperatures do not drop sufficiently by the early morning hours of the nighttime period, pollination is spread throughout the daylight hours rather than concentrated around noon. This leads to unsuccessful pollination and fertilization. These temperatures can disrupt pollination by making spikelets infertile, reducing total pollen and pollen viability, and inhibiting pollen release and germination.

The high relative humidity during this time also cannot be overlooked as this can result in suppression of pollen dissemination – in essence the pollen doesn't "fly around" as it should. Water as a liquid rather than a vapor causes pollen to rupture. Approximately 97% of rice plants are self-pollinated, depending on conditions, so heavy and uniform pollination can be a necessity at times.

Keep in mind when looking at mature rice plants that 80-90% seed set, that is filled kernels, is a very successful seed set. A preferred example is – if there are a seemingly large number of blank kernels in 200 bu/acre rice, don't worry because it likely made all it could; but if you see a large amount of blanks in 100 bu/acre rice then something went wrong.

While much of the focus has been on grain yields, milling yields are also dramatically affected by high nighttime air temperatures and temperature duration during grain filling multiple nights in a row. As nighttime air temperatures increase, chalky kernels increase (lower milling quality) and peak head rice yields decrease (lower milling yield). These two factors combine to further lower the value of rice beyond the point of just low grain yields. An indicator of lower head rice yield is low test weight – this year it was notable that rice was "light" and grains were thin – a situation prone to increased grain breakage.

Chalk and head rice yield issues have been very prevalent this year and carry similar value to direct grain yield – lower milling quality and yield decrease the value and marketability of the rice grain. In essence – what good are high grain yields if no one wants the product? Low head rice yields have affected most cultivars to a similar extent, though the varieties may have been more affected. However, the hybrids were more affected by increases in chalk.

Picture 23. Light panicles due to blanking from high temperatures.

Picture 24. Blanks covering the ground behind the combine in low-yielding field.

The varieties clearly did not deal with the heat as well as the hybrids – some of which is explainable based on differences in genetics and physiology. By that – it should be noted that hybrid florets were able to successfully pollinate even after the florets closed which most varieties are unable to do.

In addition, the japonica genetics of current long-grain varieties makes varieties more tolerant to cool early season conditions, but the believed* indica background present in hybrids would make them more tolerant to high temperatures

(*current hybrids and their genetic information are proprietary information and therefore not completely known). However, the most frequent comment about the effects of heat on varieties is "why is the heat bothering us now, it's always hot in Arkansas." Well it is and it isn't.

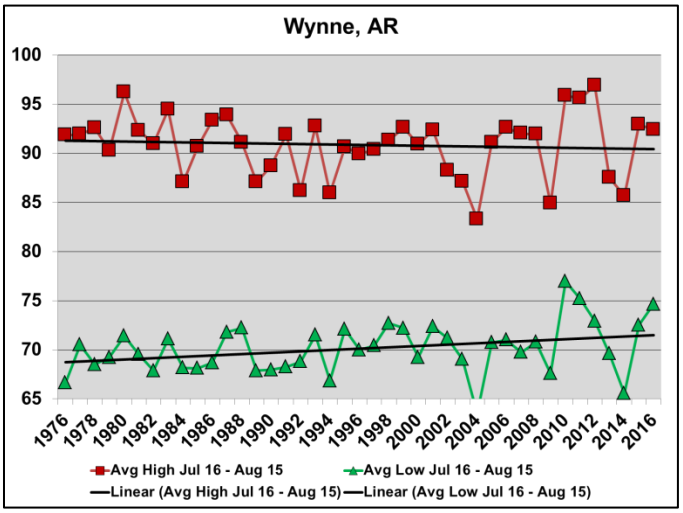
Figures 5-7 show the average daytime high and nighttime low temperature for the period of July 16-August 15. This period coincides with what is traditionally the hottest time of year in Arkansas and the time when our rice historically is heading and flowering. Average daytime highs notably rise and fall with little consistency and a relatively flat trend over time (neither increasing nor decreasing).

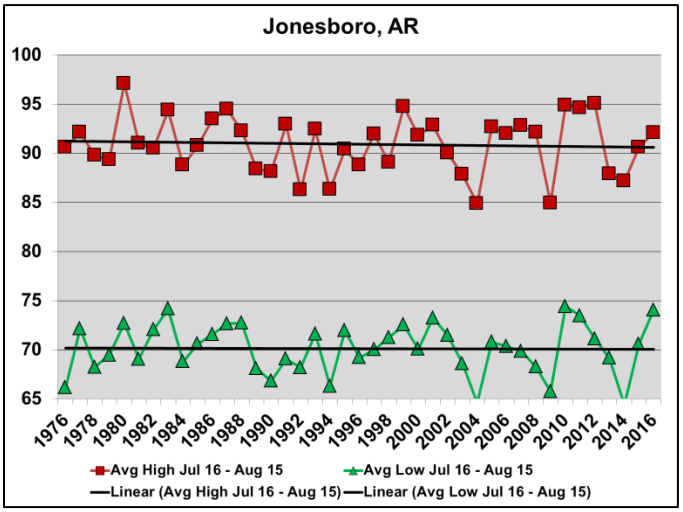
The infamous summer of 1980 still sets the high mark for daytime high temperatures. We have come close to that mark in 2010, 2011, and 2012. However, the key to the yield issue is the nighttime temperatures. The overnight lows observed in 2010, 2011, and now in 2016 have not been seen before, at least not in the last 40 years in the Arkansas Delta.

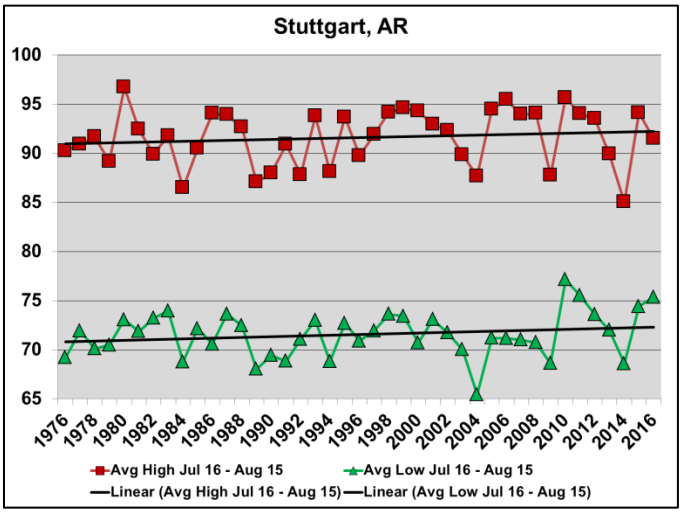
Is this the new normal or just a wrinkle in time? Unfortunately we will only find out the hard way – with time. The reality is we must act going forward as if this is the new normal. The trend indicates that nighttime temperatures during this period are increasing – but primarily on the back of the temperatures in 2010, 2011, and 2016.

We continue to move plant maturities and planting dates earlier – and by extension the period of heading and flowering. **Figure 8** shows the point at which the state of Arkansas reached 50% planting progress and 50% heading progress. So the further to the left a year is listed, the earlier planting progress reached 50% that year; also the lower a year is listed, the earlier heading progress reached 50% that year.

Figures 5-7. Average daytime and nighttime highs for July 16 – August 15 from 1976-2016 at Wynne, Jonesboro, and Stuttgart, AR (NOAA).







The years in which record state average yields were achieved are in bold and followed by an asterisk (i.e. **2014***). It should be noted that when 50% planting progress occurred in weeks 15 and 16 (the last two weeks of April) we reached record yields 44% of the time. When we reached 50% planting progress during weeks 17 and 18 (the first two weeks of May) we reached record yields 47% of the time. Essentially the same rate of record yields.

In addition to planting earlier with earlier maturities, we also plant more acres in smaller windows of time as technology and equipment advance. These have the positive of increased efficiency in production and yield potential, but the negative of not spreading out risk from things we cannot control, primarily weather.

While we still may not have escaped the heat in 2016 had we spread out planting more, the reality is we did not spread out planting and there was little chance of escape as a result. Those fields that did escape the heat either by time, field conditions, or management; did fare well and made very good yields.

The development of new varieties must continue to follow agronomic practices of growers which at this time must include increased focus on varieties that perform well planted early with increased tolerance to high daytime and nighttime temperatures.

It should be noted that this movement should not be wholesale as it may result in "throwing the baby out with the bathwater". That is, if this is not the new normal then high-yielding germplasm may be sacrificed on the altar of the pursuit of a single trait – heat tolerance. Many a breeding program has failed in the past in similar single-minded pursuits.

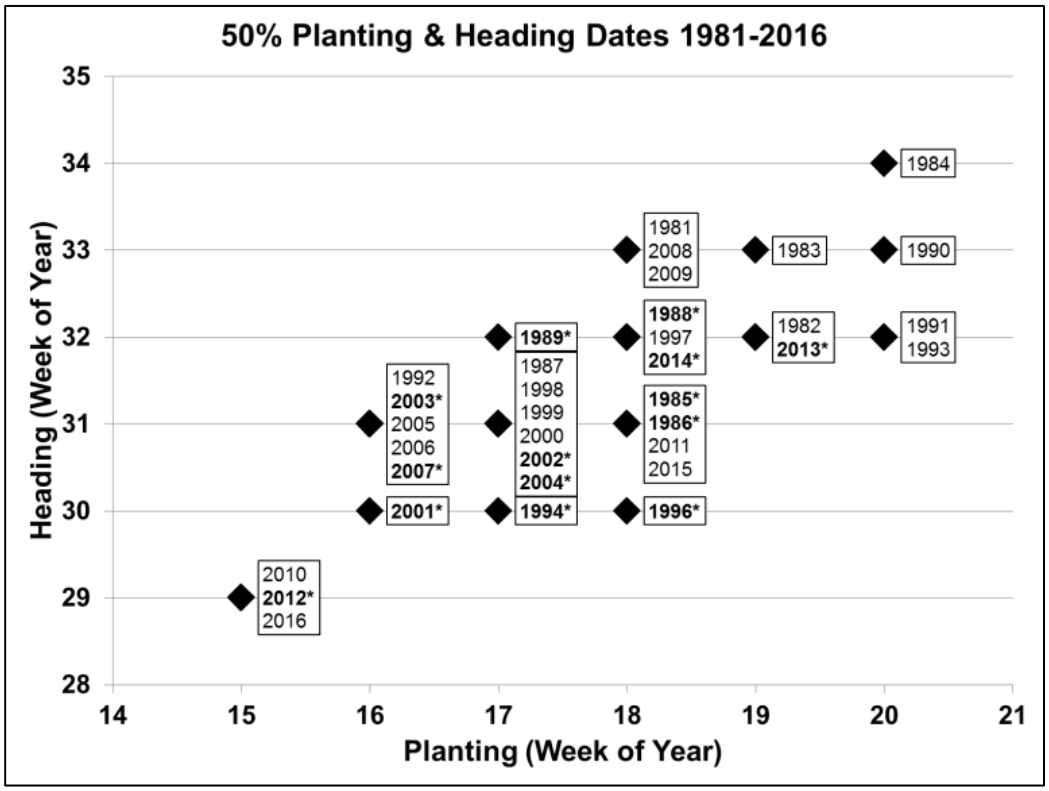



Figure 8. Week of year Arkansas reached 50% planting (x-axis) and 50% heading (y-axis) from 1981-2016 (USDA-NASS).