

EFFECT OF STORAGE ON SOYBEAN SEED VIGOR AND EMERGENCE

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Planting vigorous seed is very important in establishing a healthy soybean crop, particularly in the Southern United States where soybean planting begins in April and continues into June or July. Seed for these later plantings usually experiences increasing temperatures and humidity in storage which may reduce seed vigor, but often without a reduction in germination. Not only can storage conditions compromise the seed, but high soil temperatures, fluctuating soil moisture levels, and soil crusting may also reduce emergence, especially if seed vigor is low.

In Arkansas, stand failures in June- and July-planted soybeans are not uncommon, but it is not known if these failures were due to a loss in seed vigor, harsh planting conditions, or both. To determine the effect of commercial storage on soybean seed vigor and emergence, two cultivars (UA4910 and Osage) were stored at three locations in a commercial seed warehouse in Dewitt, AR, in 2011. These locations represented a good area in the warehouse to store seed, a bad area and an on-farm area. The seed was stored in commercial, 25kg seed bags on wooden pallets. Each location had four replicate bags of each cultivar, a temperature and relative humidity sensor (WatchDog Data Logger Model 100, Spectrum Technologies Inc. Plainfield IL) was placed in one bag of each cultivar and one on the outside of a bag to measure ambient conditions. A set of bags was also placed under controlled environmental conditions at the Arkansas State Plant Board to serve as a control. Seed was sampled from each bag every two weeks from April into August and standard germination (SG), accelerated aging (AA), and Seed Vigor Imaging System (SVIS) ratings were determined. AA and SVIS are measures of seed vigor. Seed was also planted at the Vegetable Research Station, Kibler, AR, and emergence at two and four weeks was determined.

Under controlled environmental conditions, there was little change in SG, AA, or SVIS throughout the season. There was little change in SG throughout the season at the warehouse or on-farm locations, but AA and SVIS declined significantly. Declines in AA and SVIS began in mid-May at the on-farm location and mid-June at the good and bad warehouse locations. By mid-August, AA values measured 15-20% at the on-farm site, 42-45% for the good site, 55-58% for the bad site and 65-70% for the control while SG ranged from 70-85%. Temperature and relative humidity remained constant under the controlled environmental conditions (20°C and 60% RH). At the warehouse locations, temperature ranged from 20-35° C and 60-63% RH at the good location, 20-37°C and 40-61% RH at the bad location and 15-33° C and 60-75 % RH at the on-farm location. Field emergence was high for all locations through mid-June and then fell to less than 5% when air temperatures reached over 38° C. Once air temperatures fell below 35° C in mid-August and early September, stands increased and differences in stand reflected both AA and SVIS ratings. Poor stands in late-planted soybeans in Arkansas appear to be due to both a loss in seed vigor during storage and very hot weather conditions at planting.

Effect of Storage on Soybean Seed Vigor and Emergence

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Importance of Seed Vigor

- Soybean seed vigor
 - Affects emergence
 - Can decline rapidly in storage
 - Standard germination poor indicator of vigor
- Arkansas
 - Planting begins in April ends in July
 - Late plantings more emergence problems
 - Seed for late planting can experience high temperatures during storage
- Objective: What effect does initial seed vigor and storage conditions have on seed vigor at planting?

Materials and Methods

- Storage
 - 2009 to 2011
 - Three commercial warehouses: Cache, Fisher, Dewitt
 - Three sites/warehouse: Good, Bad, Farm
 - Control: Arkansas State Plant Board (2010, 2011)
 - Two seed lots: high quality and low quality
 - Stored in paper seed bags on pallets
 - Present data from Hornbeck Seed, Dewitt, AR
- Experimental design: 4 replications, one bag/replication

Materials and Methods

- Sampling
 - Every two weeks
 - Sent to Arkansas State Plant Board: Aaron Palmer
 - Standard Germination
 - Accelerated Aging (AA)
 - Temperature and relative humidity
 - WatchDog Data Logger Model 100, Spectrum Technologies Inc. Plainfield IL
 - In the bag
 - Outside of bag

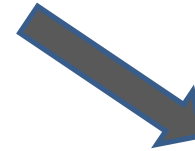
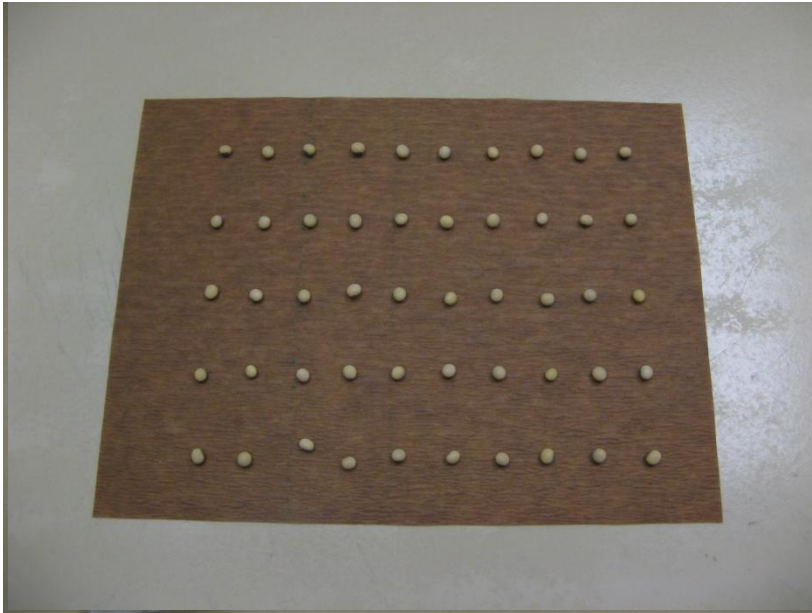
Hornbeck Seed, DeWitt, AR



Storage Location



Standard Germination



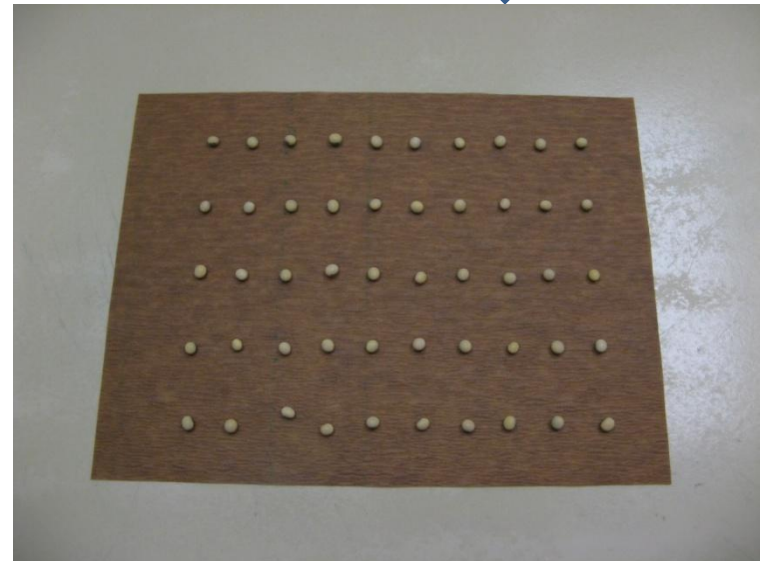
Cover and place in
growth chamber for 7
days

- 16h light @ 30 ° C
- 8h dark @ 20 ° C



Accelerated Aging

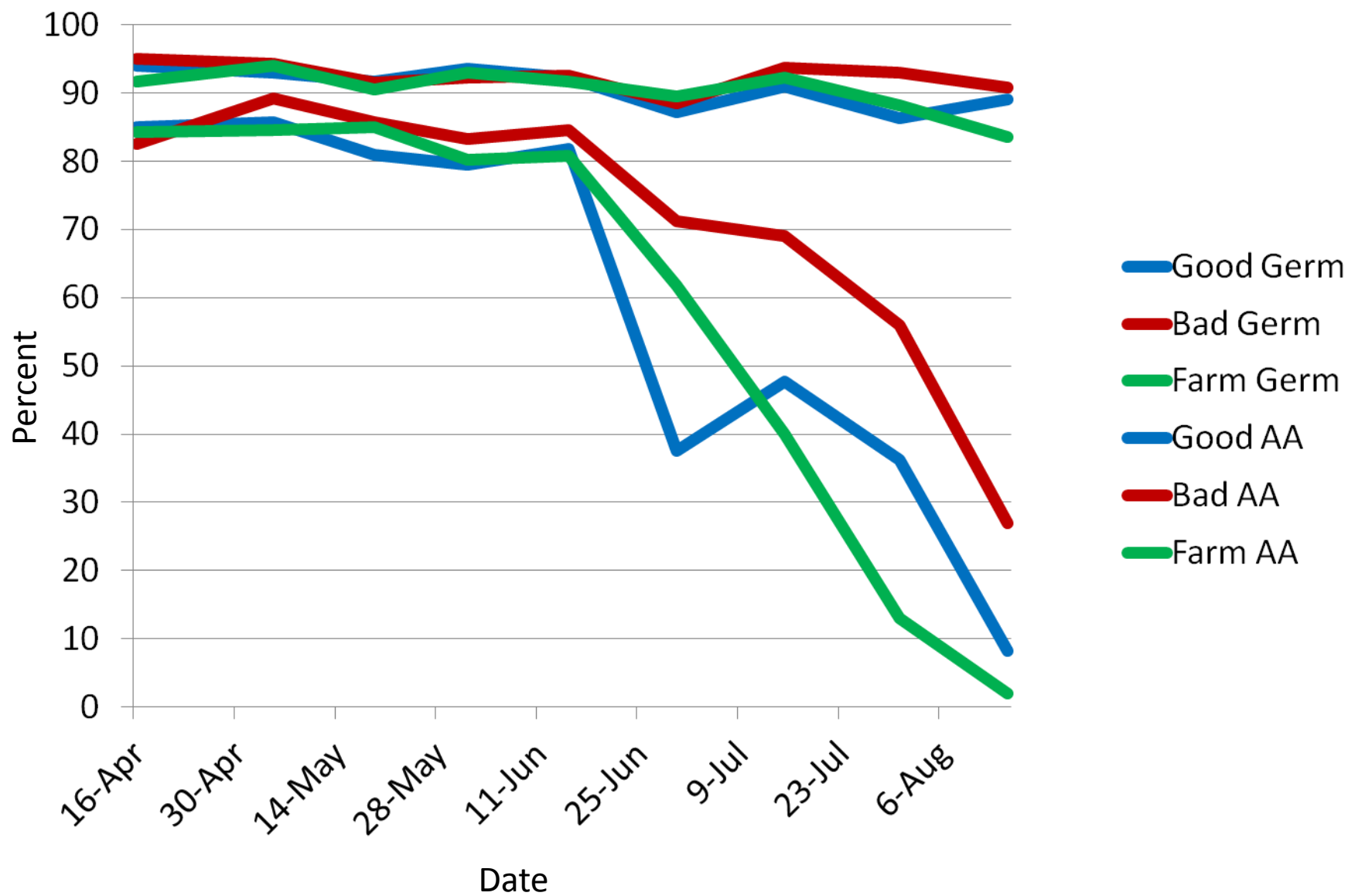
41°C (106°F)
Near 100% RH
72 hr
Dark



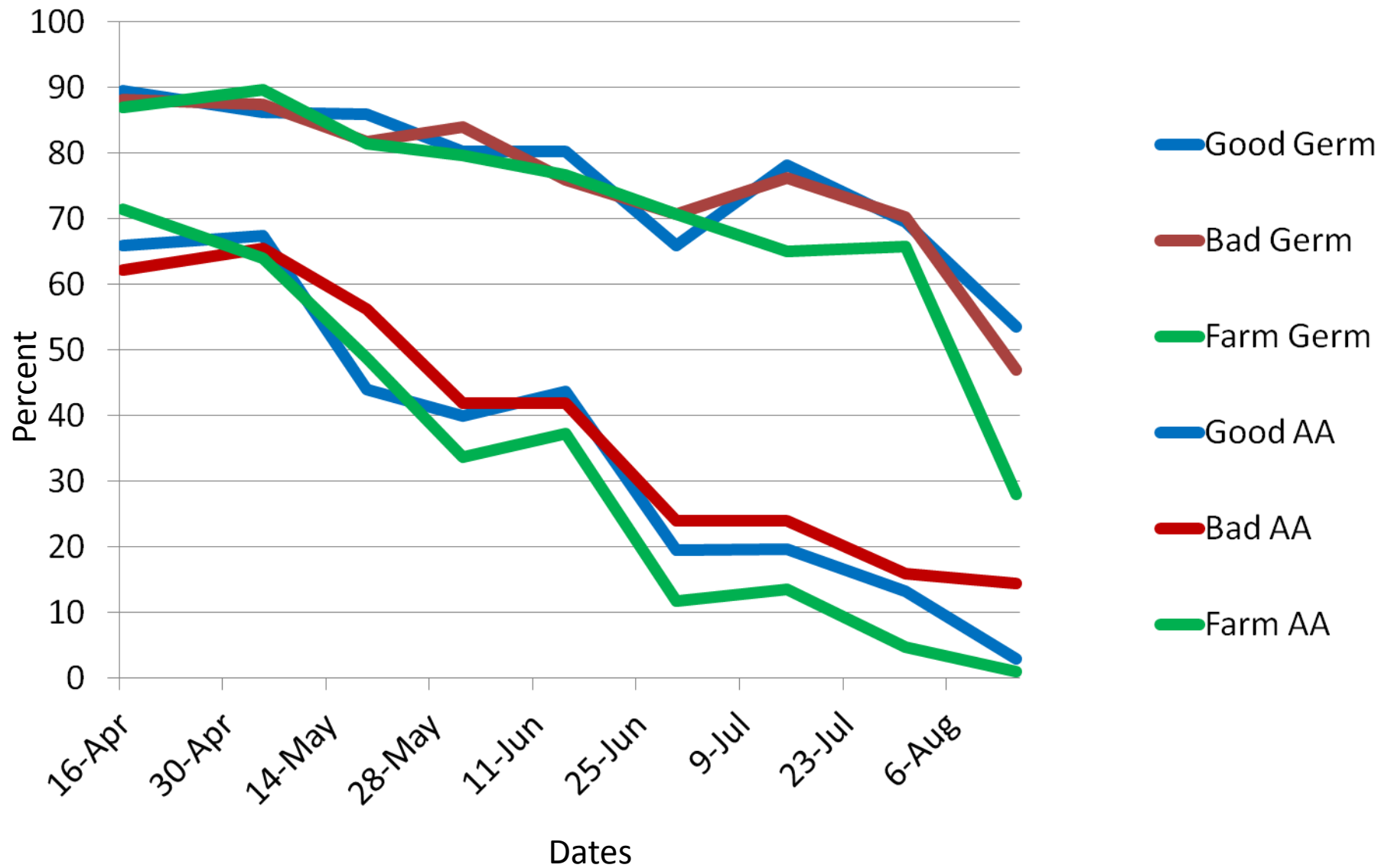
Results: ANOVA

Year	Standard Germination	Accelerated Aging
2009	Cultivar X Environment X Time	Cultivar X Environment X Time
2010	Cultivar X Time	Cultivar X Environment X Time
2011	Cultivar X Environment X Time	Environment X Time

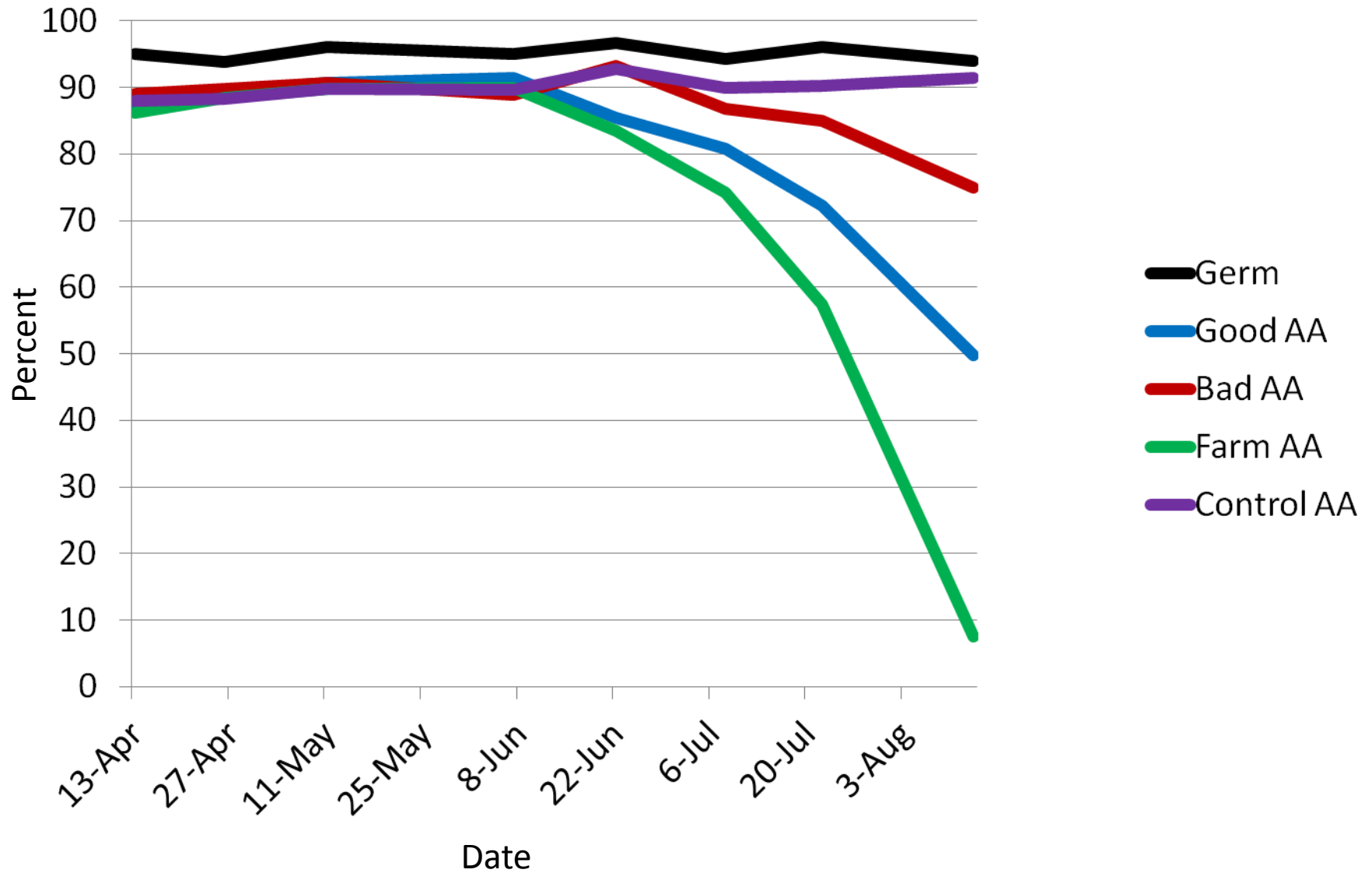
Armor 38G2: 2009



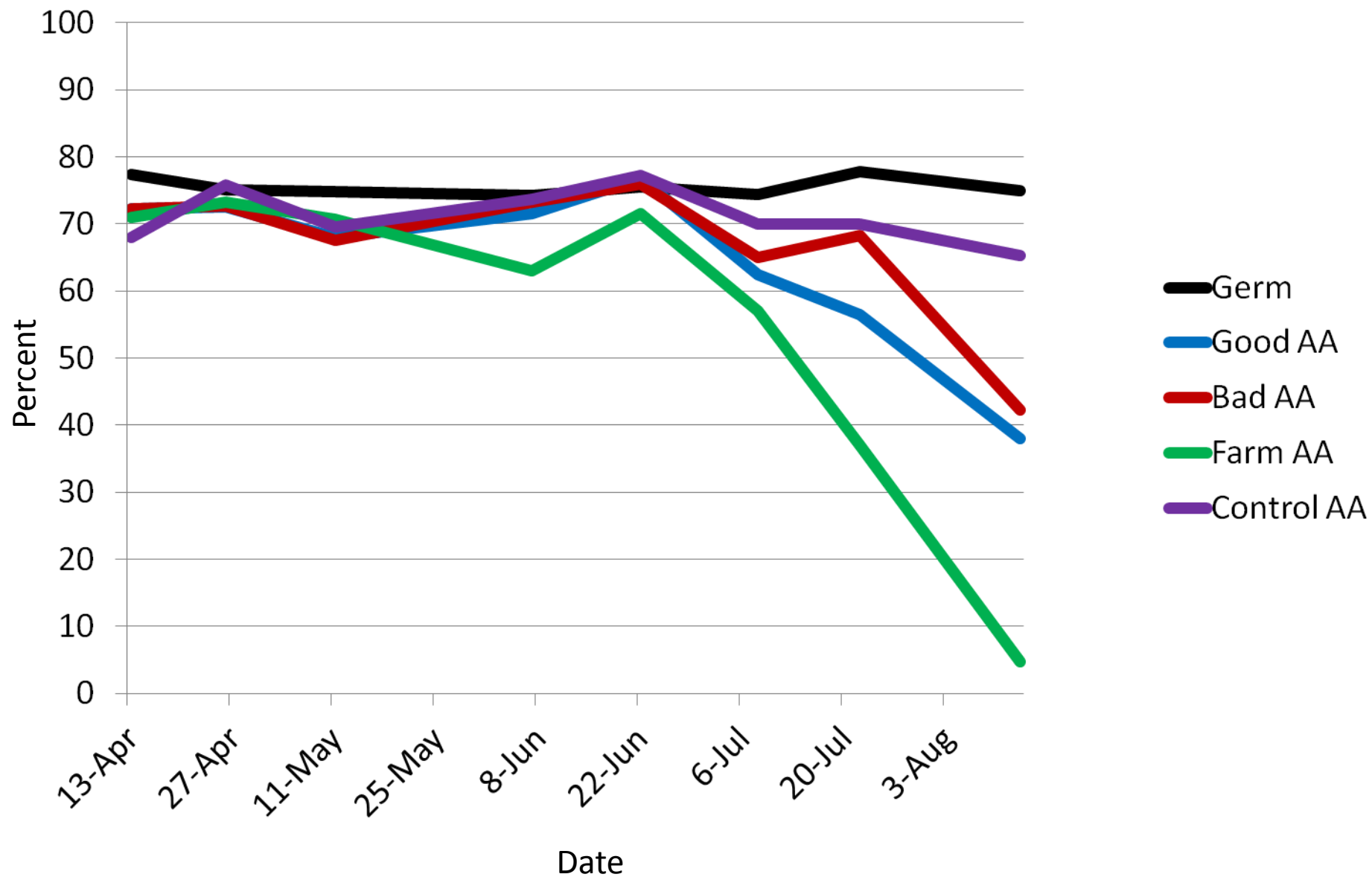
DK 4995: 2009



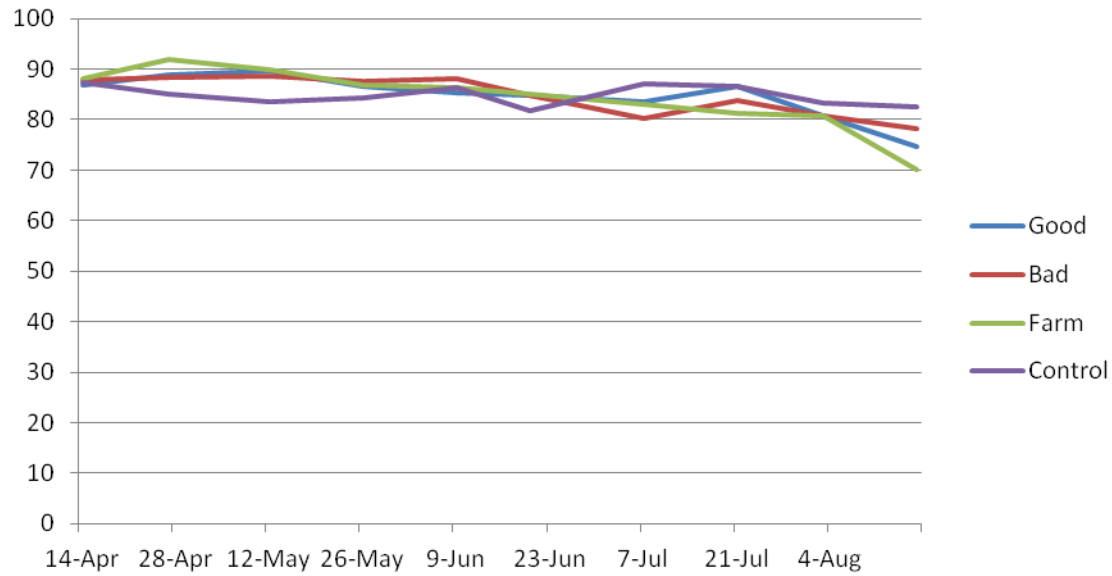
DK 4968: 2010



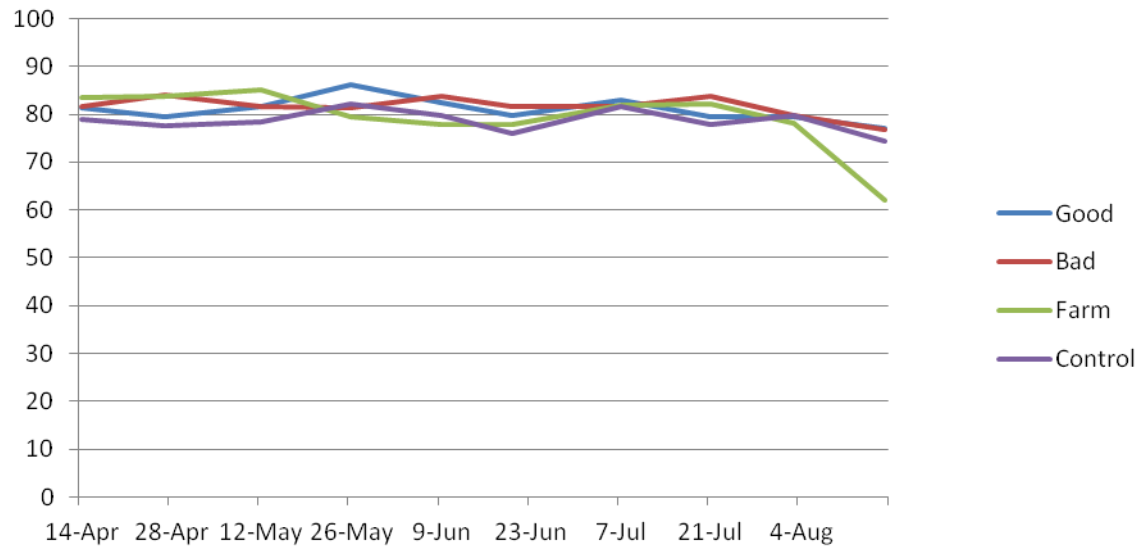
Armor 47G7: 2010



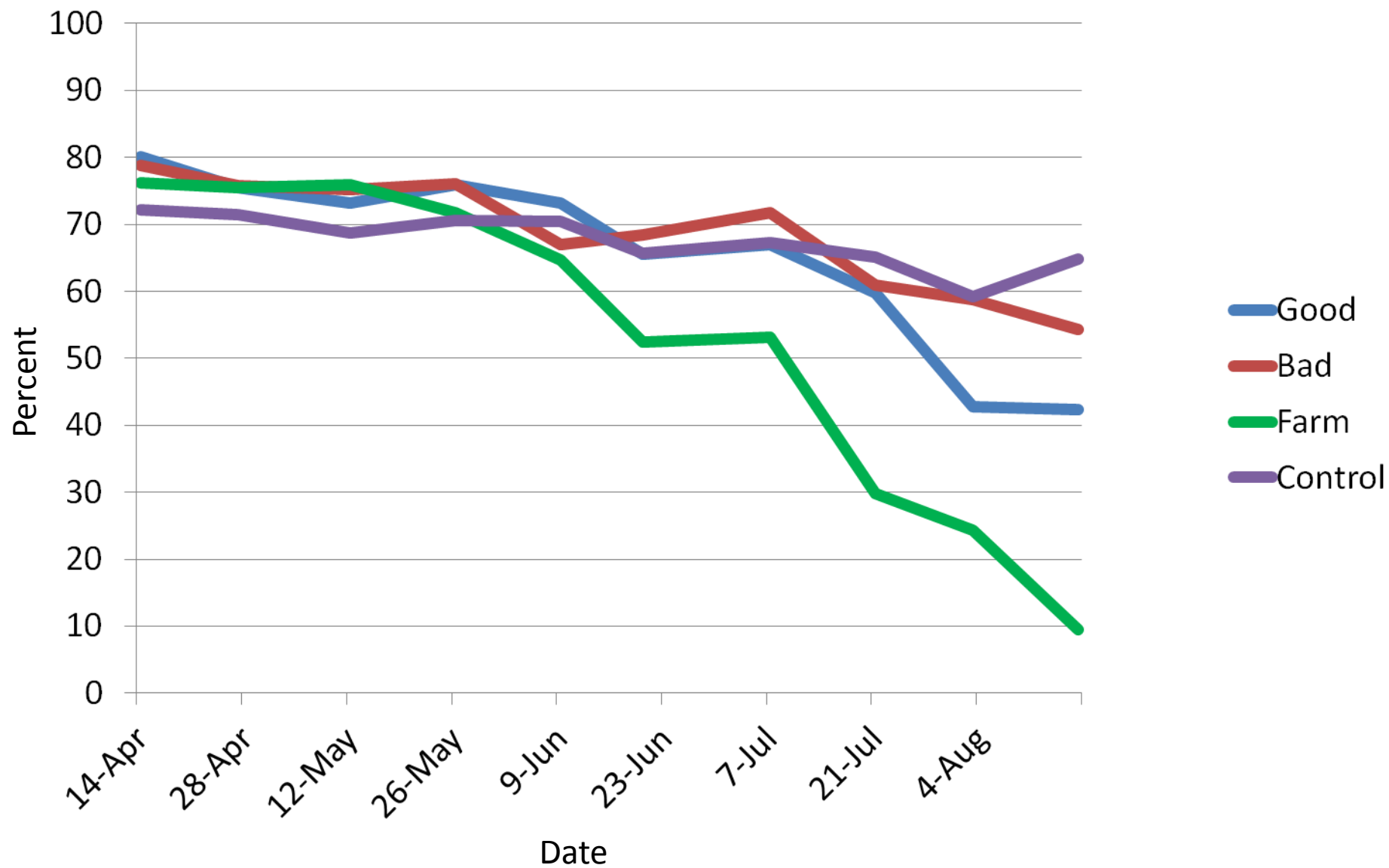
UA4910: Germ 2011



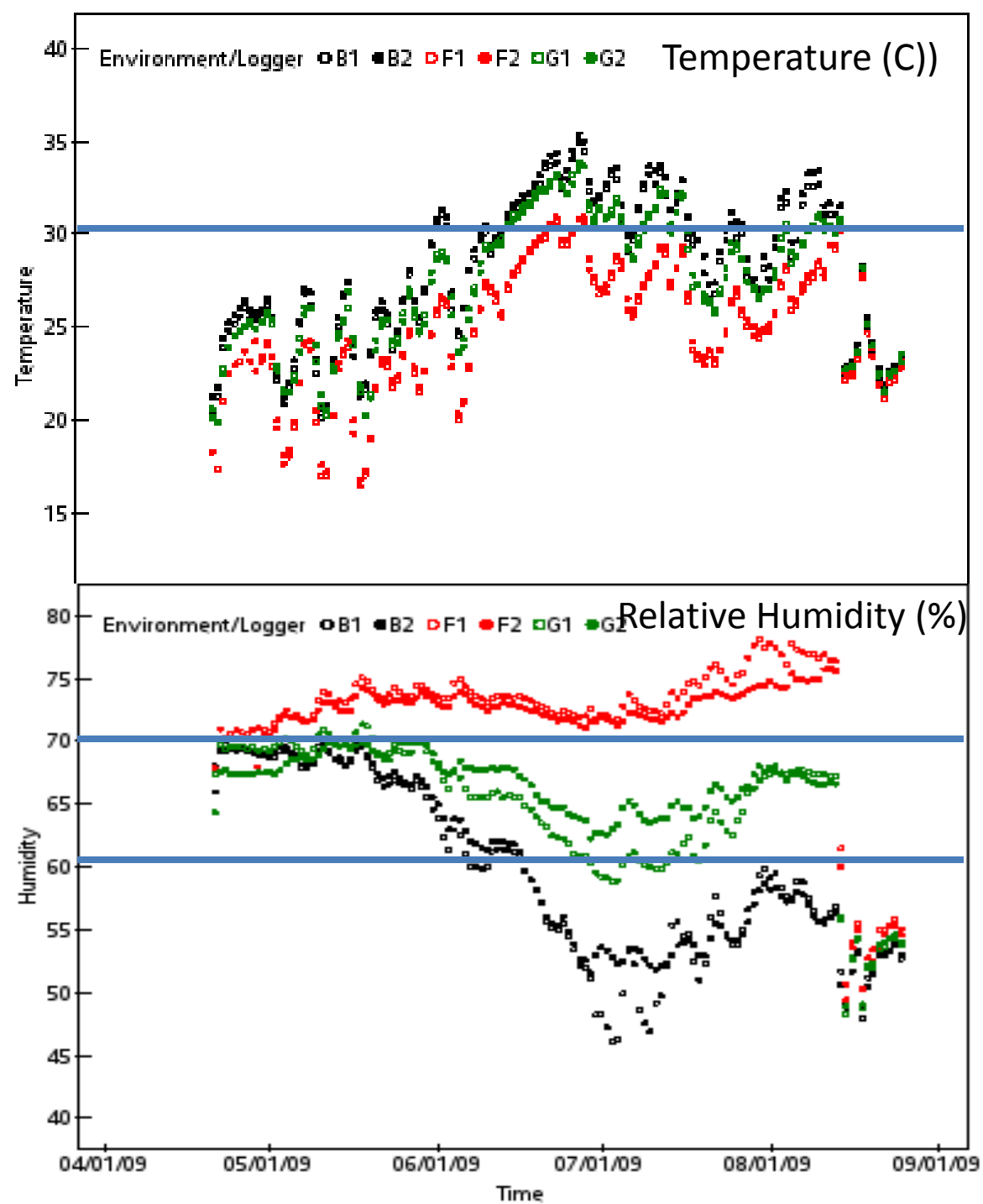
Osage: Germ 2011



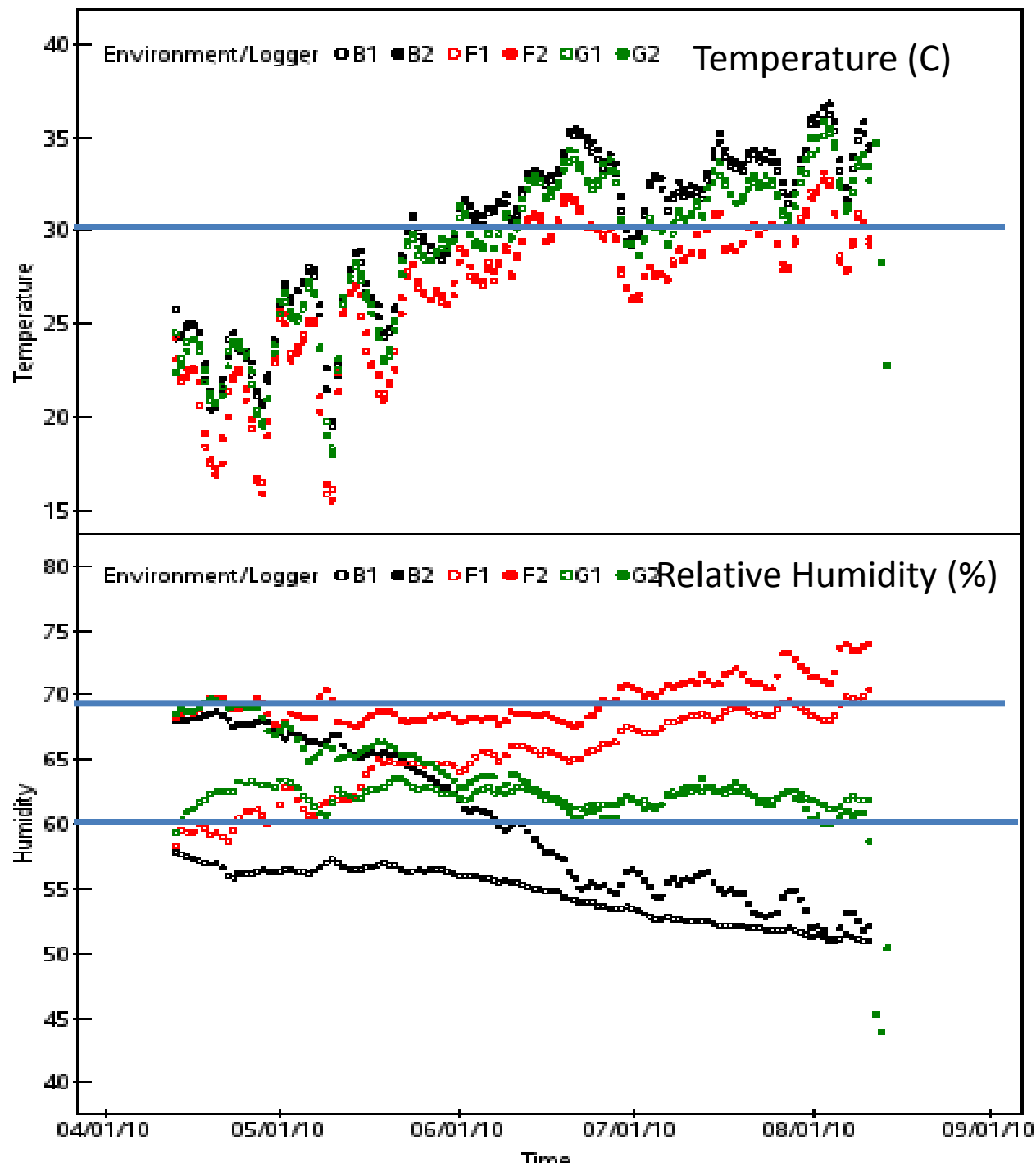
Osage and UA4910:AA 2011



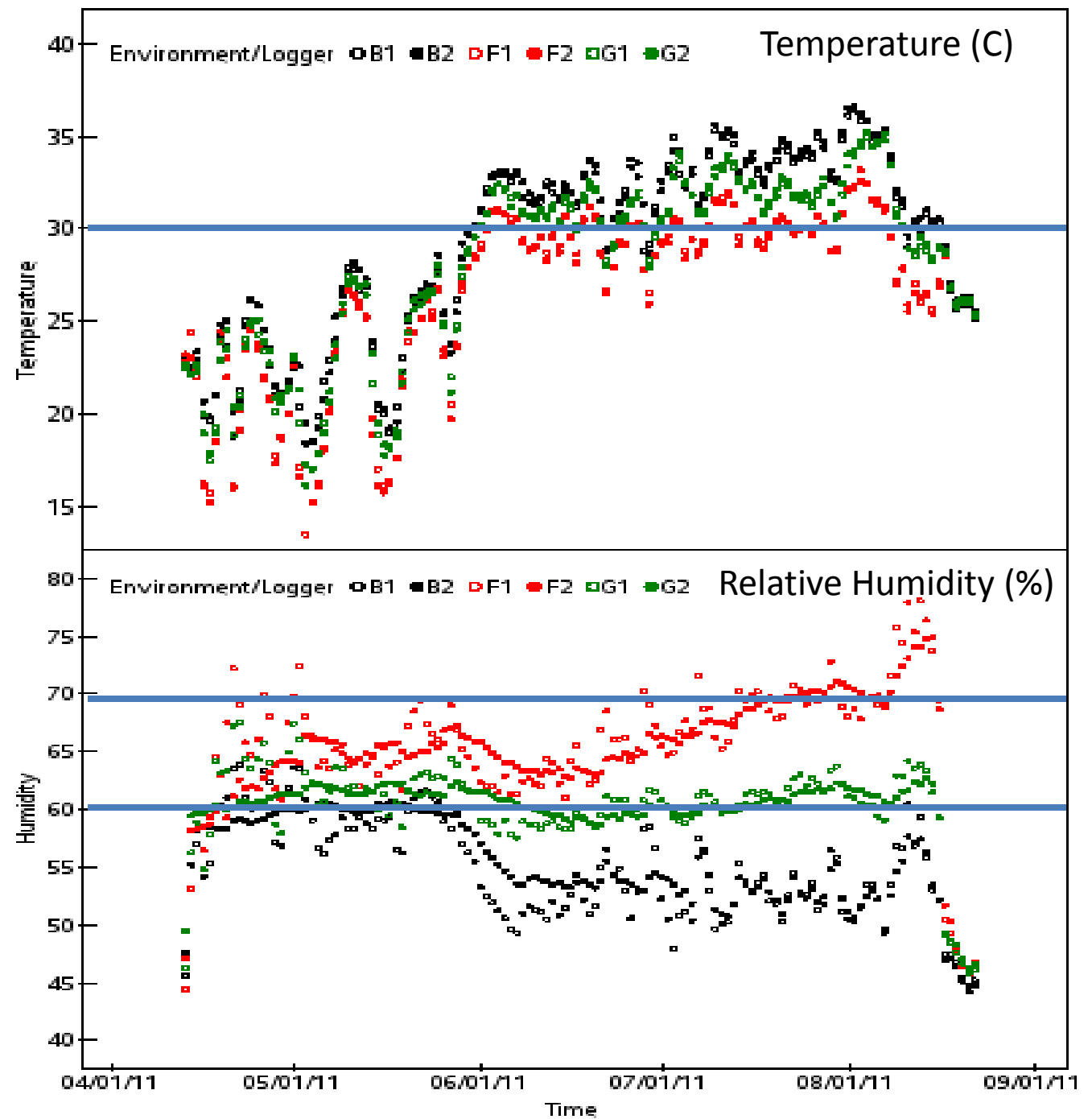
2009



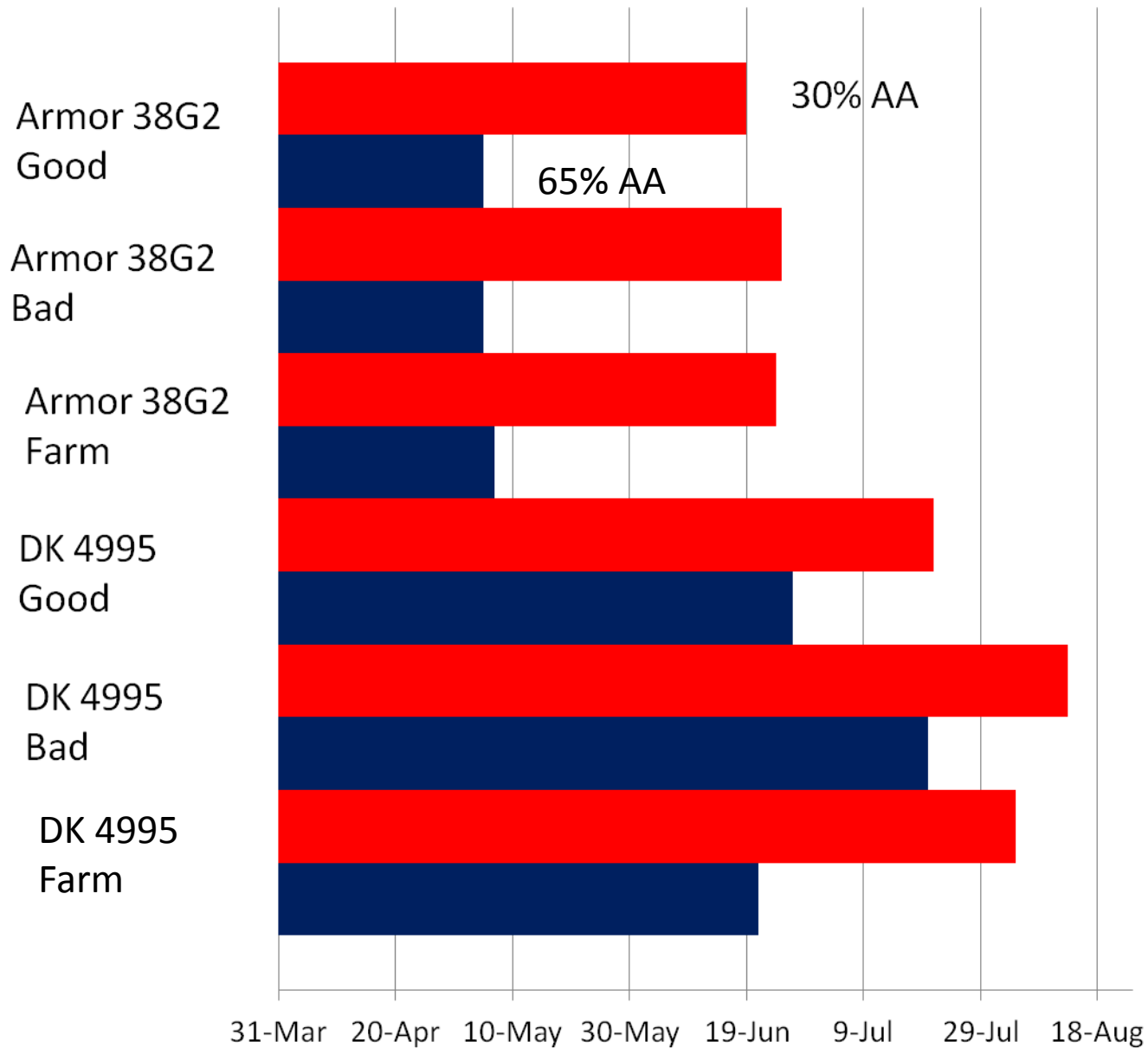
2010



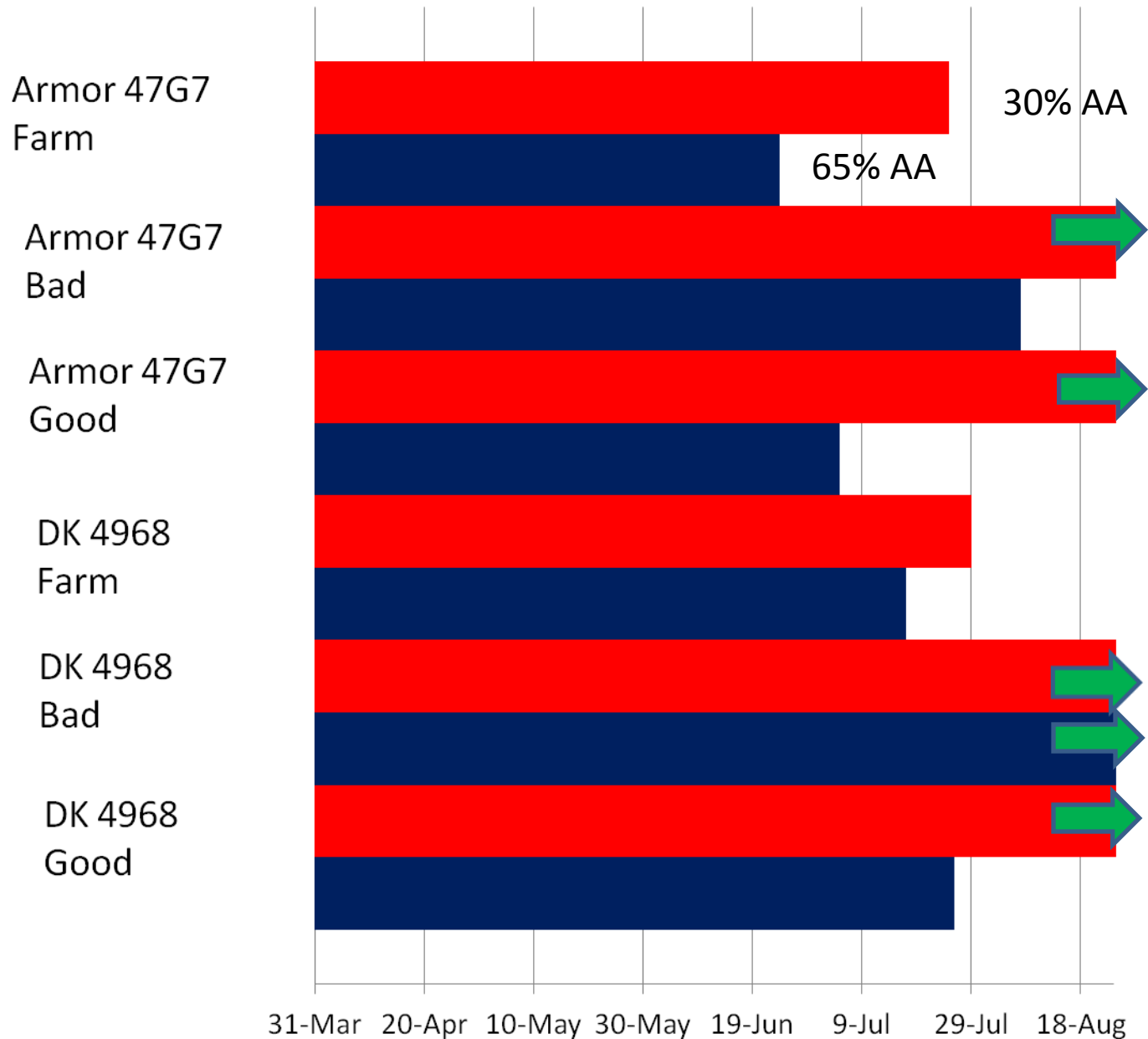
2011



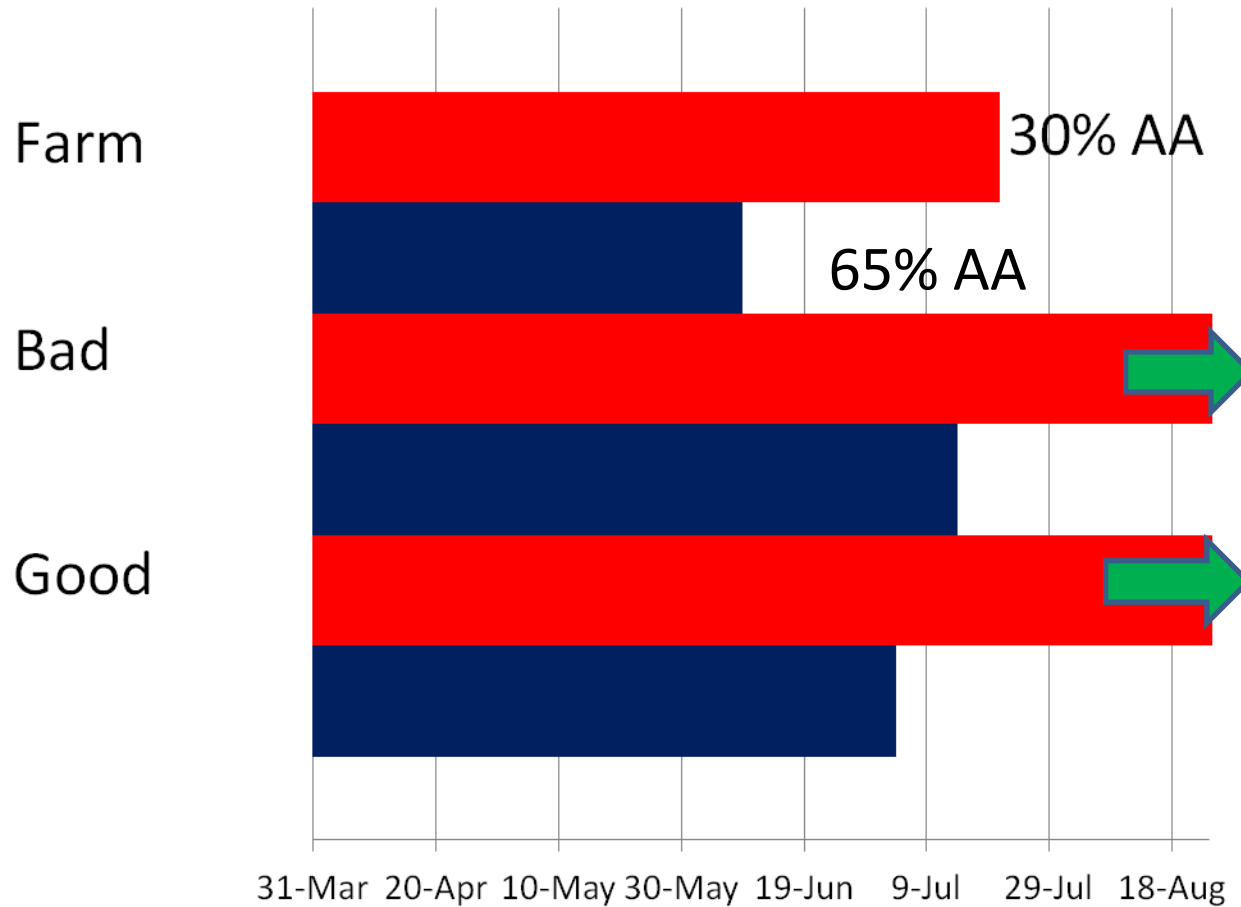
Dates of 65 and 30% AA: 2009



Dates of 65 and 30% AA: 2010



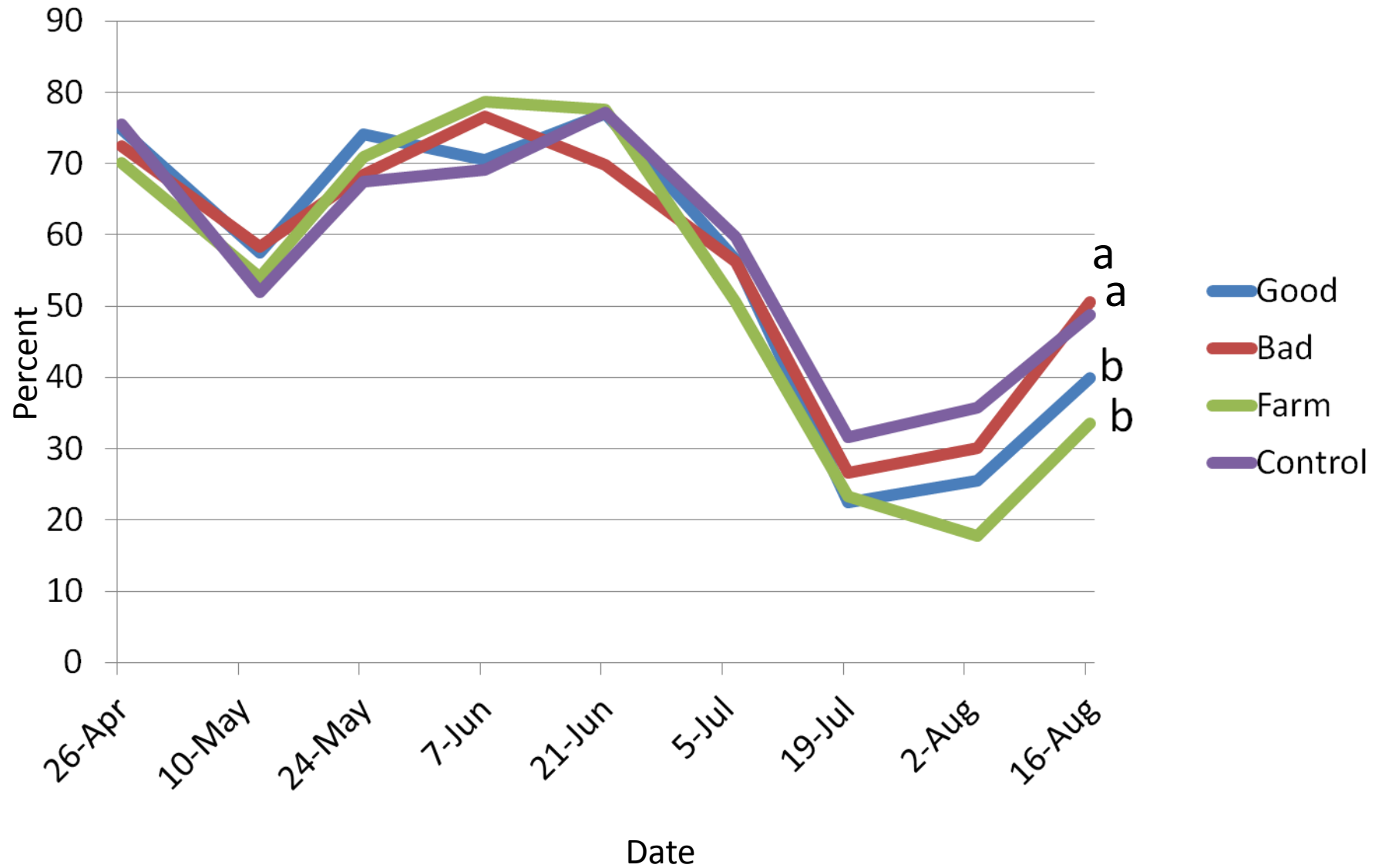
Dates of 65 and 30% AA: 2011



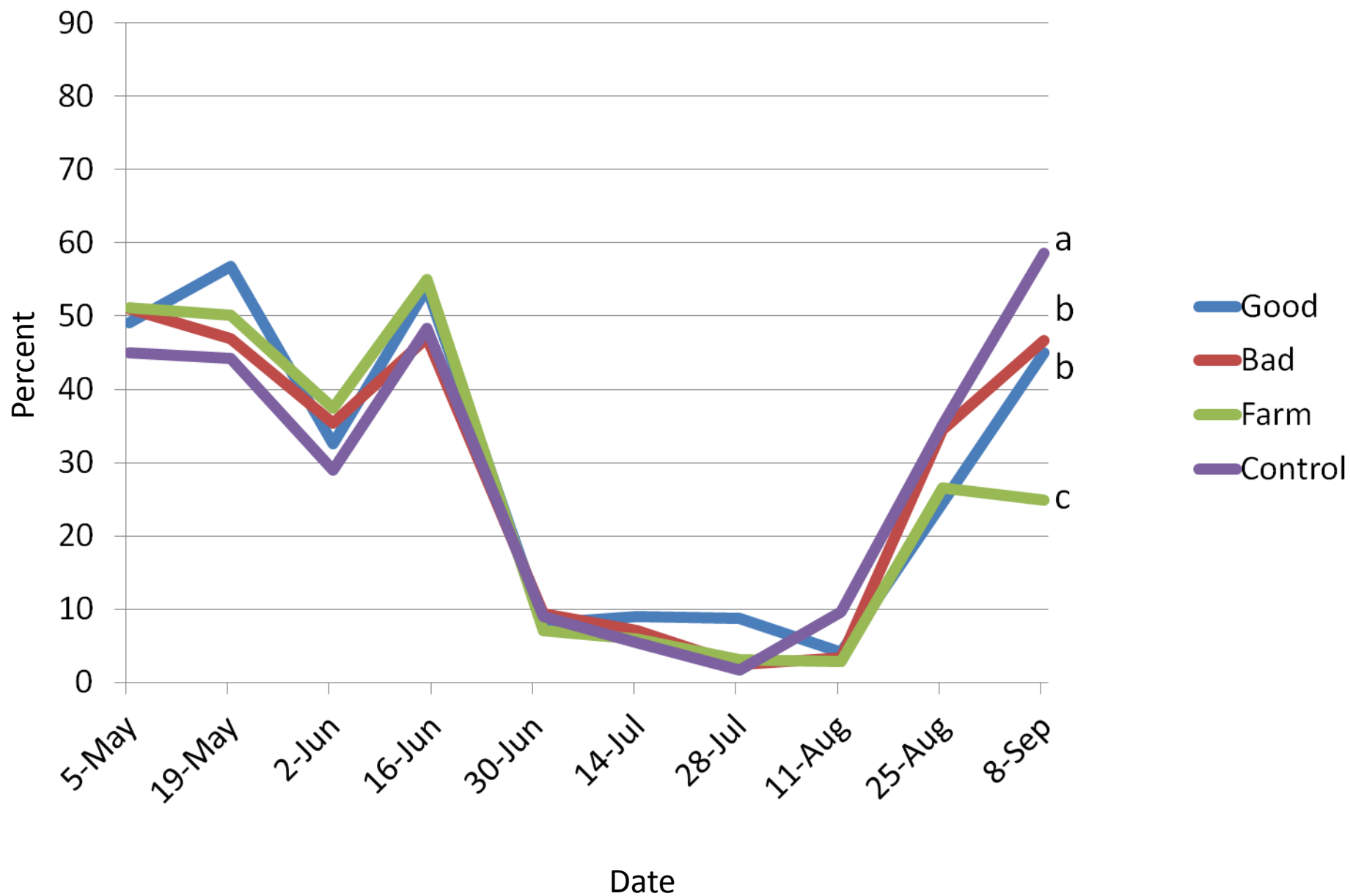
Seed Quality and Emergence

- 2010 and 2011
- Vegetable Research Station, Kibler, AR
- Seed from Hornbeck and Plant Board
- 200 seed/rep, 5 replications
- Stands counted at 2 wk
- Plots irrigated

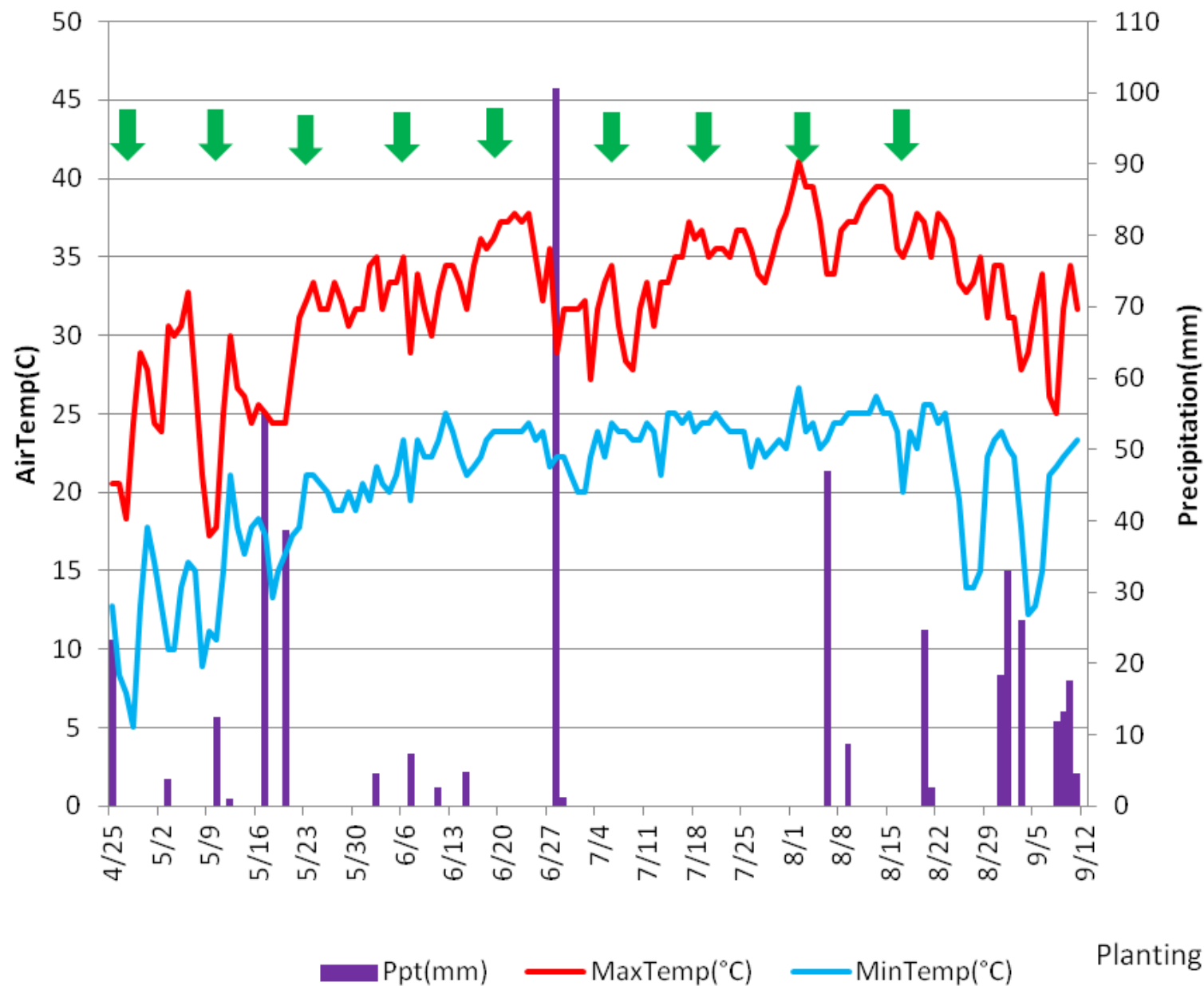
Emergence by Storage: 2010



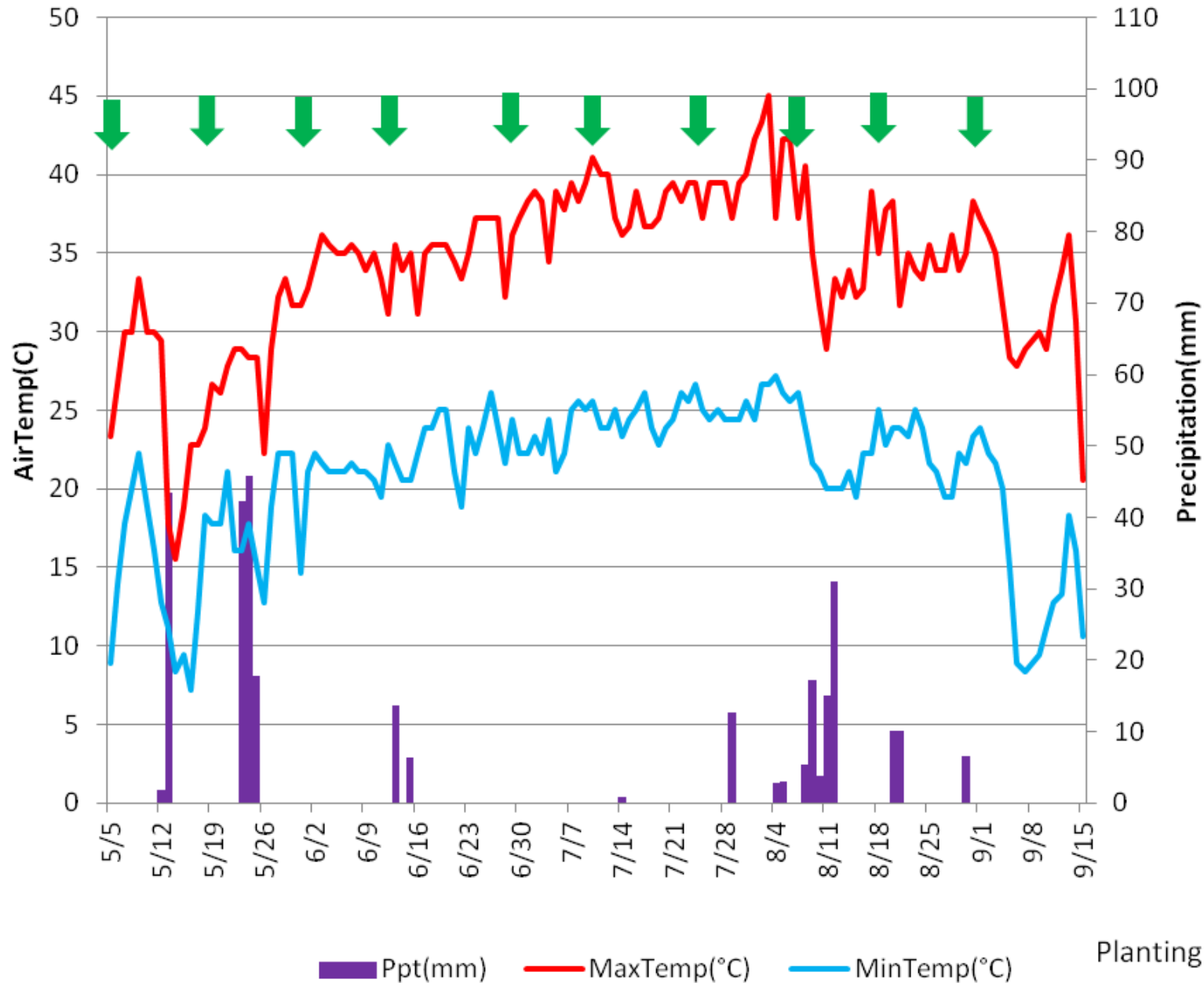
Emergence by Storage: 2011



Kibler Weather 2010



Kibler Weather 2011



Conclusions

- Seed vigor during season depends on
 - Initial vigor
 - Relative humidity more important than temperature
- Emergence
 - Soil temperature
 - Seed vigor
- Both seed vigor and soil temperatures could affect emergence of late planted soybean