Fertilizer and Lime Board – Annual Report 2005
(1.5 years into the study)

1. Title: Using High Boron Application Rates to Control Weevils and Leafhoppers in Alfalfa

2. Investigators: Dale G. Blevins, Professor and Wayne Bailey, Associate Professor, Division of Plant Sciences, University of Missouri

3. Objective: to determine if high application rates of boron (B) will control weevils, leafhoppers and grass invasion into alfalfa stands, in order to reduce pesticide and herbicide utilization.

4. Alfalfa establishment: A site was selected at the University of Missouri South Farm in the summer of 2004. This site is near the University of Missouri's Entomology Building at South Farm, and is ideally located for the labor intensive insect counting that will be required. Soil samples were collected from this site and analyzed at the University of Missouri Soil Testing Laboratory in summer 2004. Mean values from the soil test results are listed in Table 1.

Table 1. Initial Soil Test Results from the South Farm Alfalfa Site.

pH	O.M. %	Bray I P lb/A	Ca lb/A	Mg lb/A	K lb/A	CEC meq/100g
6.6	2.7	46	4308	446	163	13.9

We selected two different alfalfa cultivars for this study, Pioneer 54V46 (leafhopper susceptible) and Pioneer 54H91 (leaf hopper resistant). Seeds from both cultivars were Nitragen Plus (they were supplied already inoculated with rhizobia). Alfalfa planting date was Sept 18, 2004, after removal of the forage sorghum crop. The forage sorghum had been planted in June, 2004 to draw down soil nitrogen. Alfalfa was planted with a Tye Pasture Placer 80 inch No-till drill. A 52 Vicon PS 103 Spreader was used on Oct 5 to apply 0-50-300 P_20_5 and K_20 fertilizer onto plots, based on the soil test results in Table 1. Plots were 20'x30' with 14' alleys and each treatment was replicated four times. The treatments were 0, 2.5, 5.0, 10.0 lbs/acre B treatments, with one set of plots allocated for insecticide (w/o B) treatments and with the two different cultivars.

The alfalfa emerged quickly, the stand was excellent and the plants showed good fall growth. However, during late fall of 2004, we had heavy rainfall, which resulted in water standing on the plots. By spring 2005, it was obvious that most of the alfalfa plants had died over winter. Therefore the alfalfa was re-planted on March 30, 2005 and again we got an excellent stand. On April 1, 2005, turf-type tall fescue was planted into the borders of the plots, and on April 2, 2005 plots were sprayed with Paraquat to remove spring weeds. On March 16, 2005, the first application of 2.5lbs B (as Solubor, a gift from U.S. Borax) was applied to each B treatment plot. The Solubor was mixed with fine sand and broadcast. On June 1, the second 2.5 lbs B was applied to plots that were to

receive 5.0 or more lbs of B/acre. The 10 and 20 lbs B/acre plots were treated with boron again on June 16, this put the B up to 7.5 lbs B/acre on the 10 and 20 lbs B/acre plots. On July 5 and September 7, 2005, 10 insect sweeps were made on each plot. The insects were collected in plastic bags and frozen. Insect identification and counts will be made this winter, using the frozen material. Immediately after the insect samples were taken, the forage was sampled for hay yield determination, and all forage was harvested from the plots. Therefore, the maximum B applied for the insect counts and hay yields in 2005 was a total of 7.5 lbs B/acre. On October 5, another 2.5 lbs B/acre was applied completing the 10 lbs B/acre application. On October 8 and 26, B was applied to the 20 lbs B/acre plots, raising the total applied to 15 lbs B/acre. On the plots that were to receive a total of 20 lbs B/acre, we started noticing some leaf damage after the application of 15 lbs B/acre. Therefore for these high B treatment plots, we have not yet added the final 5 lbs B/acre. These final B applications will be completed in spring of 2006.

Hay yields were increased with B applications to alfalfa cultivar 54H91, which is leafhopper resistant, however there was no clear response for cultivar 54V46, which is leafhopper susceptible (Figures 1,2 & 3). The lack of response of cultivar 54V46 may be a result of the higher population of large weed species in control plots of this cultivar, as seen in Figure 4 on the right side. Yields were very good for the first and second cuttings in July and September, 2005, respectively. Total hay production was also very good for first year alfalfa. At the first cutting date, the alfalfa plots had quiet a few weeds, and in addition, one could clearly see the superiority of the leaf hopper resistant cultivar (Figure 4, left side). The leaf hopper resistant cultivar clearly responded to B applications up to 5 lbs B/acre (Figures 1, 2 and 3). The B applications to this resistant cultivar increased hay yields by 1500 lbs/acre total. This 1500 lbs/acre yield increase when comparing 0 B to 5 lbs B/acre rates, came from a 1000 lbs/acre increase at the July harvest and a 500 lbs/acre increase at the September harvest (Figures 1 and 2).

In summary, the 5 lbs B/acre application to the leafhopper resistant cultivar, Pioneer 54H91, increased hay yield by ¾ of a ton/acre (Figure 3). This could be worth about $90/acre and could easily pay for the seed, the B and provide extra profit!

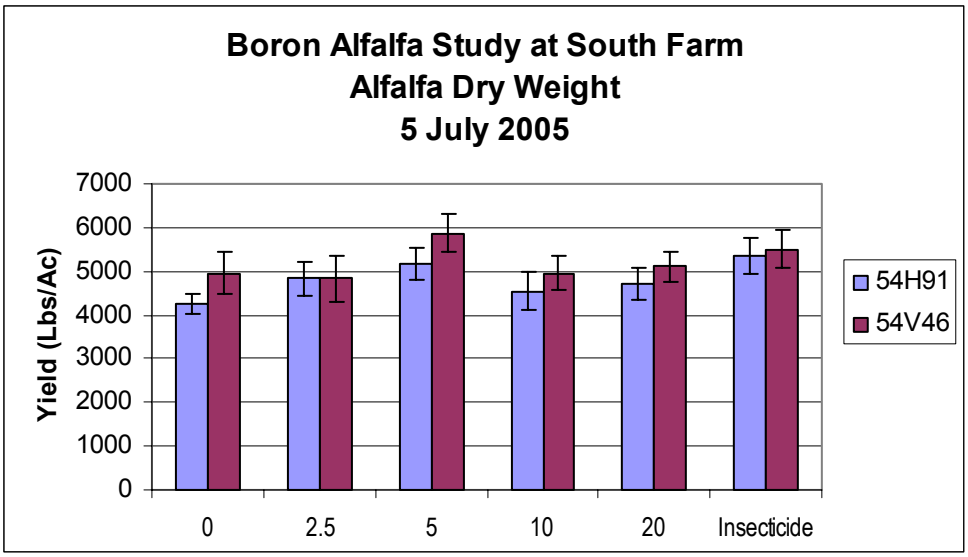

Figure 1. First cutting hay yields in 2005 after boron treatments of leaf hopper resistant (54H91) and leafhopper susceptible (54V46) alfalfa. Even the 10 and 20 lbs B/acre applications are listed on the Figure, only a total of 7.5 lbs B/acre had been applied to these plots by harvest time. Boron was only applied at a rate of 2.5 lbs B/acre at each application to prevent leaf burn, and a subsequent application was made only after a rainfall event.

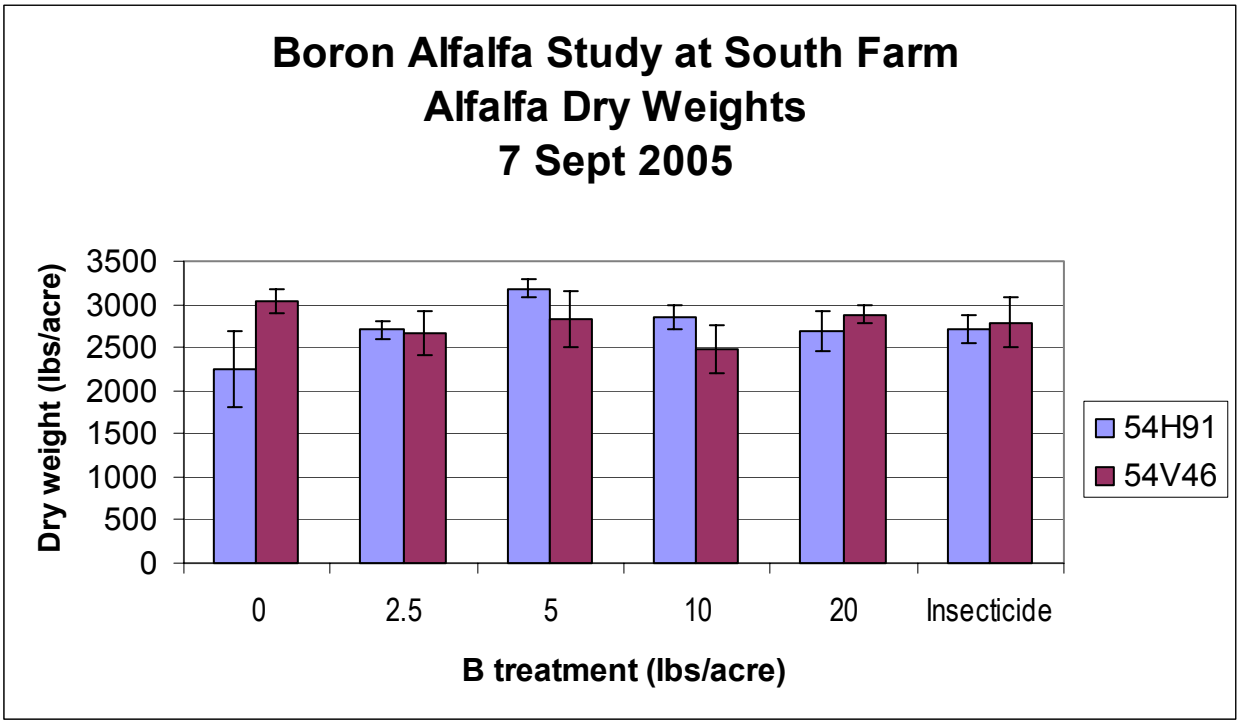

Figure 2. Second cutting hay yields in 2005 after boron treatments of leaf hopper resistant (54H91) and leafhopper susceptible (54V46) alfalfa. Even the 10 and 20 lbs B/acre applications are listed on the Figure, only a total of 7.5 lbs B/acre had been applied to these plots by harvest time. Boron was only applied at a rate of 2.5 lbs B/acre at each application to prevent leaf burn, and a subsequent application was made only after a rainfall event.

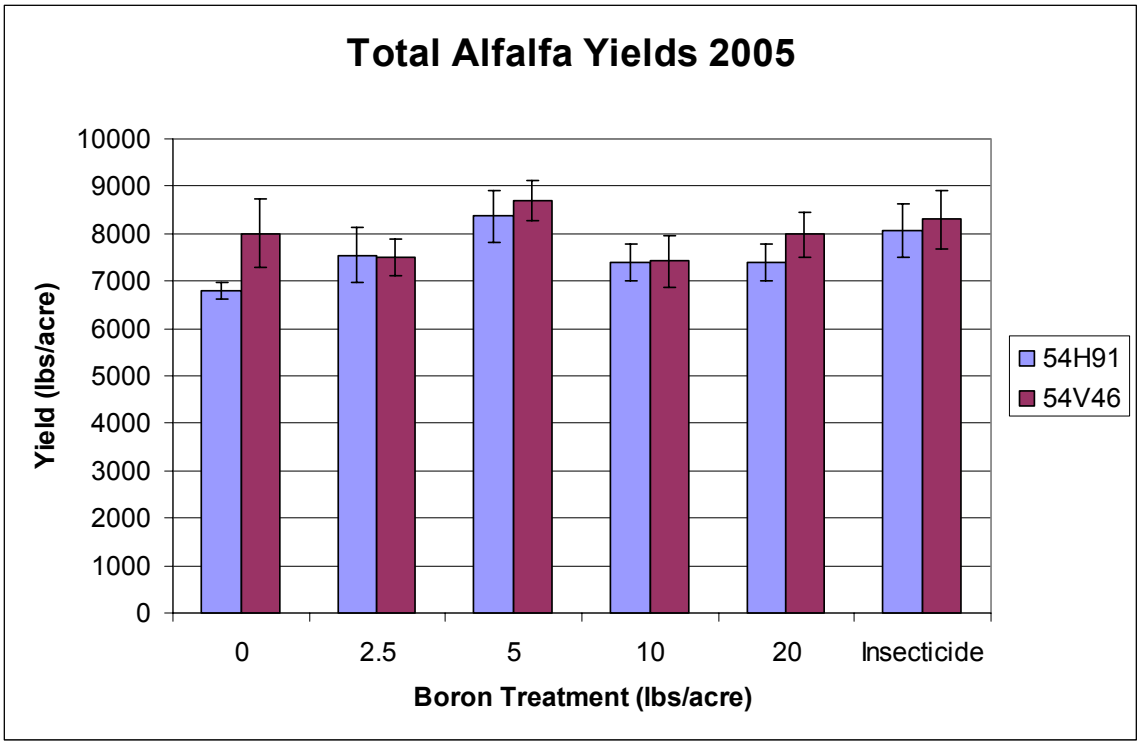

Figure 3. Total hay yields from summer 2005 after boron treatments of leaf hopper resistant (54H91) and leafhopper susceptible (54V46) alfalfa. Even the 10 and 20 lbs B/acre applications are listed on the Figure, only a total of 7.5 lbs B/acre had been applied to these plots by harvest time. Boron was only applied at a rate of 2.5 lbs B/acre at each application to prevent leaf burn, and a subsequent application was made only after a rainfall event.

Figure 4. Leaf hopper resistant (Pioneer 54H91) on the left and leaf hopper susceptible (Pioneer 54V46) alfalfa on the right in early July prior to the first hay harvest.