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Evaluation of the Effect of Pyraclostrobin on Soybean Plant Stress

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Introduction

Pyraclostrobin, a strobilurin fungicide, has received increased attention due to claims the chemical improves plant health, allowing for more efficient nitrogen uptake, overall better plant growth, and increased tolerance to stress factors such as heat, hail, wind, and drought (BASF). There are also reports of physiological changes from pyraclostrobin such as increasing photosynthesis efficiency (BASF). Fluorescence ratio (Fv'/Fm') is one parameter used to evaluate the effect of plant stress. Fv'/Fm' measures maximum quantum efficiency of PSII reaction centers. Higher Fv'/Fm' values indicate plants are using photons more efficiently and are therefore less stressed (Nason et al., 2007).

Objectives: Therefore, the objective of this study was to evaluate the effect of pyraclostrobin application to soybeans (*Glycine max* L. Merr.) on:

1. Fluorescence ratio when pyraclostrobin is omitted from the enhanced soybean production system.
2. Fluorescence ratio when pyraclostrobin is added to the traditional soybean production system.
3. Control of brown spot and frogeye leaf spot.

Methods

- Field study conducted in 2013 at three locations:
 - Clinton County, OH
 - Delaware County, OH
 - Henry County, OH
- Omission trial, randomized complete block design with four replications (Table 1)
- ASGROW 3231 seed, 3.2 maturity group, metalaxyl, pyraclostrobin, fluxapyroxad, and imidacloprid seed treatment (Acceleron)
- Planted at 358,000 seeds/ha in 38 cm rows
- Pyraclostrobin (Headline) applied at R3 growth stage at 420g/ha
- Measurements:
 - Collected before application (BA) at R2, two weeks after application (2 WAA) at R4, and four weeks after application (4 WAA) at R6
 - Visual disease ratings for brown spot and frogeye leaf spot collected from top, middle, and bottom third of soybean plant canopy
 - Fluorescence ratio calculated with LI-6400XT
- Analyzed with PROC MIXED in SAS at $\alpha = 0.05$. Single degree of freedom contrasts used to compare Enhanced to E-F and Traditional to T+F.

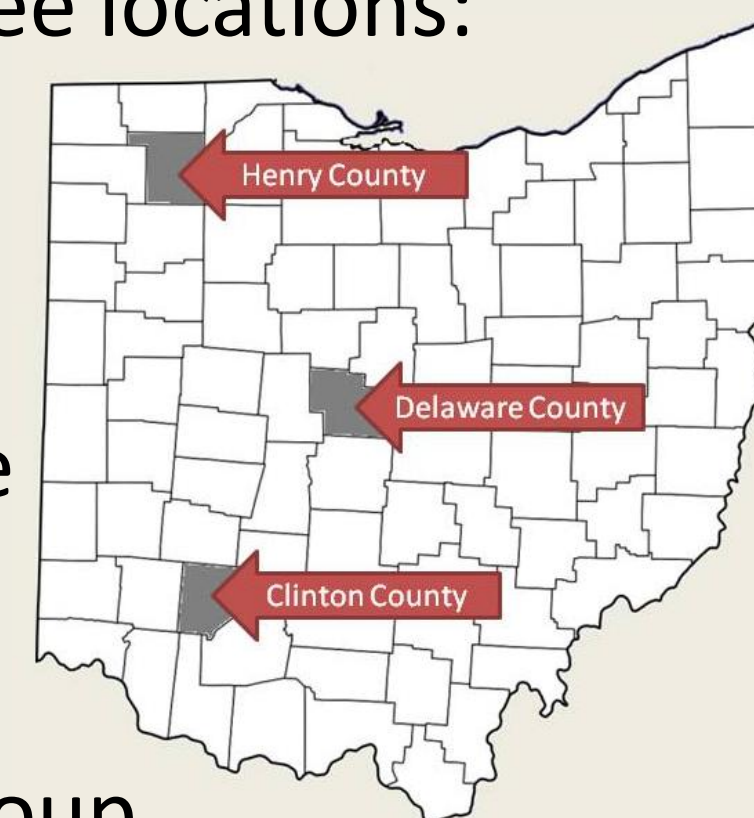


Table 1 Trial Treatments. Note: Highlighted treatments are topic of poster discussion

Trt #	Trt Name	Inoculant	Gypsum	Fungicide	Insecticide	Mn ²⁺
1	Enhanced	Yes	Yes	Yes	Yes	Yes
2	E - R	No	Yes	Yes	Yes	Yes
3	E - G	Yes	No	Yes	Yes	Yes
4	E - F	Yes	Yes	No	Yes	Yes
5	E - I	Yes	Yes	Yes	No	Yes
6	E - Mn	Yes	Yes	Yes	Yes	No
7	Traditional	No	No	No	No	No
8	T + R	Yes	No	No	No	No
9	T + G	No	Yes	No	No	No
10	T + F	No	No	Yes	No	No
11	T + I	No	No	No	Yes	No
12	T + Mn	No	No	No	No	Yes

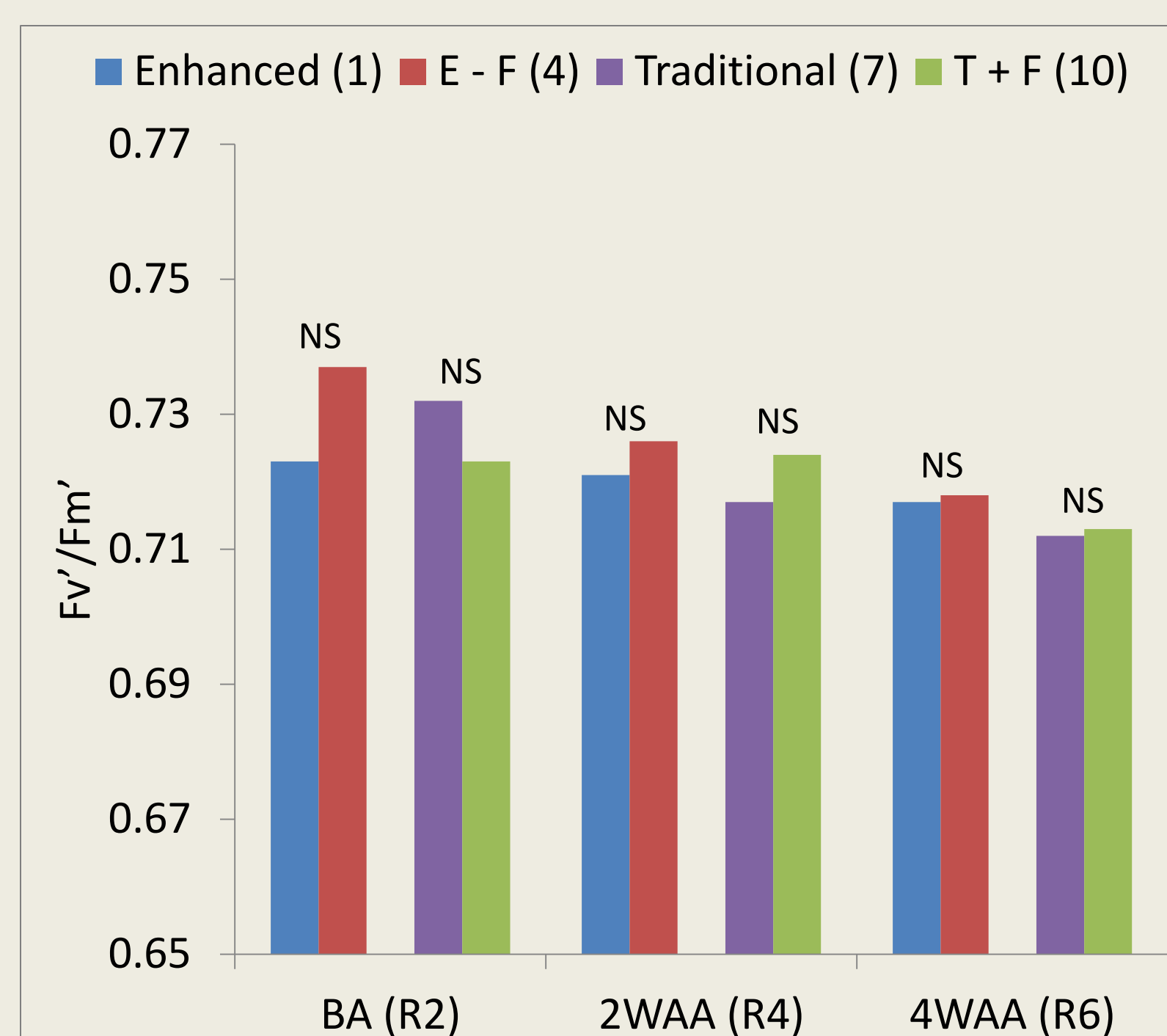


Fig. 1 Fluorescence ratio (Fv'/Fm') for Clinton County before application (BA) at R2, 2 weeks after application (2WAA) at R3 and 4 weeks after application (4WAA) at R6.

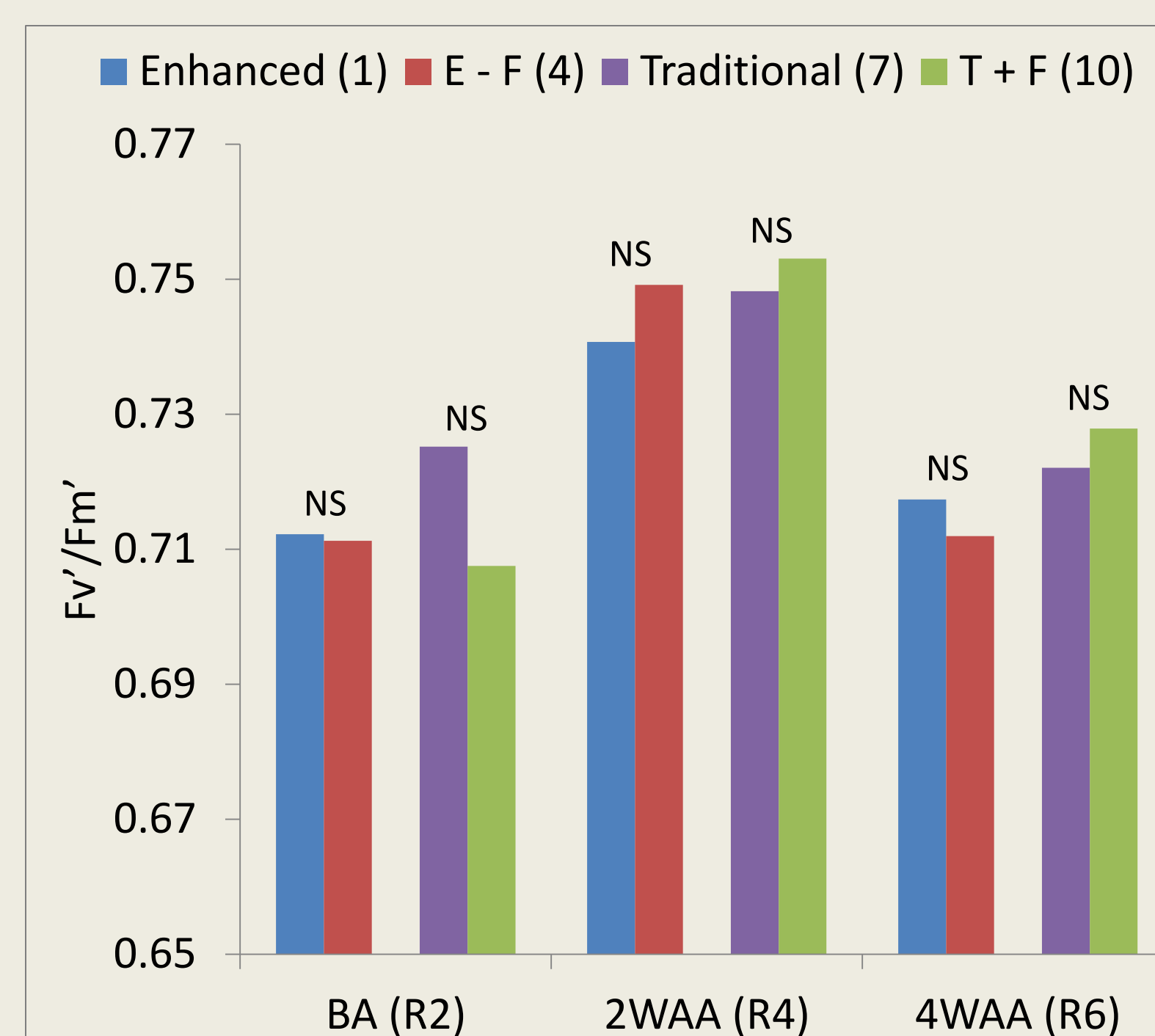


Fig. 2 Fluorescence ratio (Fv'/Fm') for Delaware County before application (BA) at R2, 2 weeks after application (2WAA) at R3 and 4 weeks after application (4WAA) at R6.

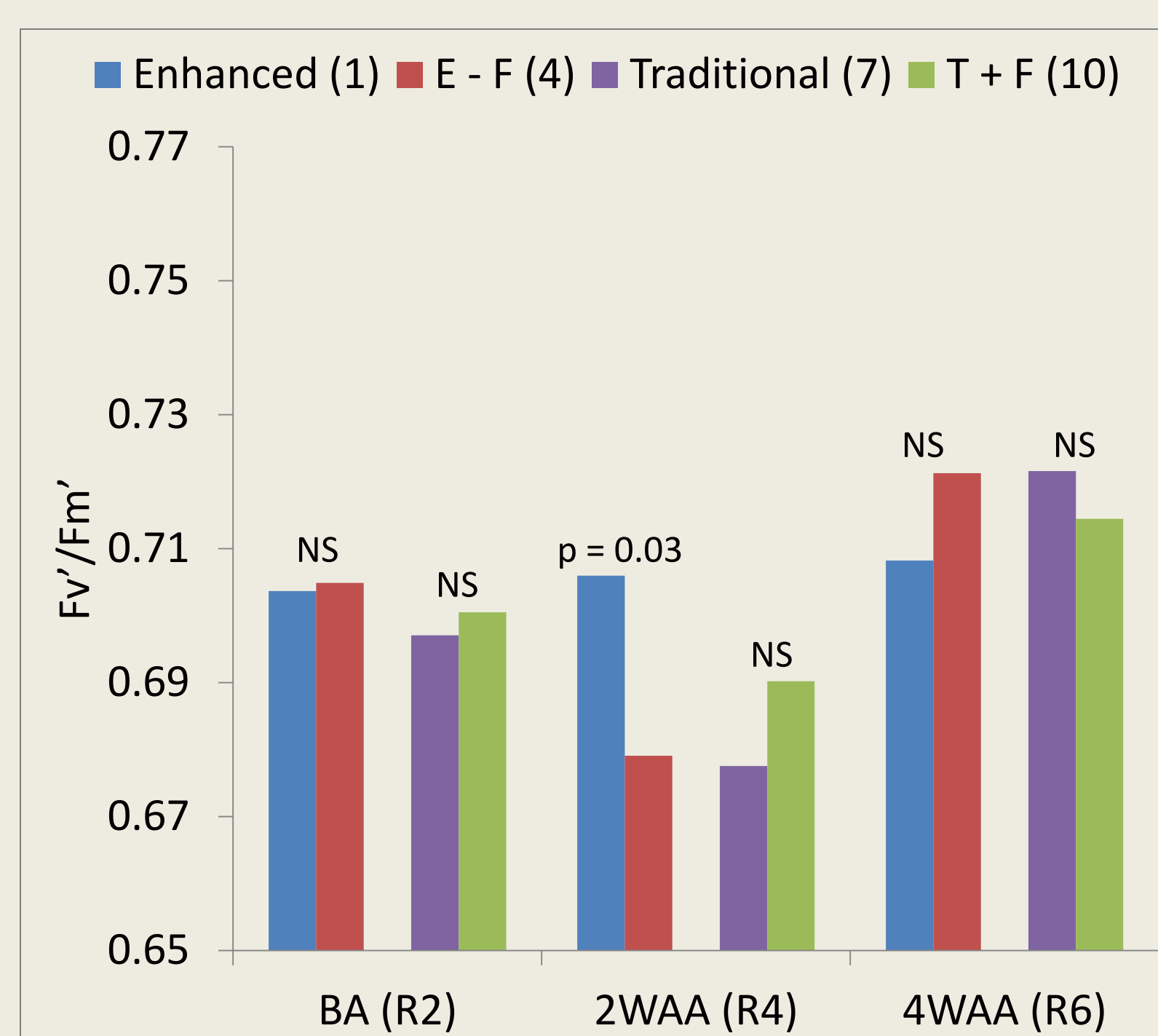


Fig. 3 Fluorescence ratio (Fv'/Fm') for Henry County before application (BA) at R2, 2 weeks after application (2WAA) at R3 and 4 weeks after application (4WAA) at R6.

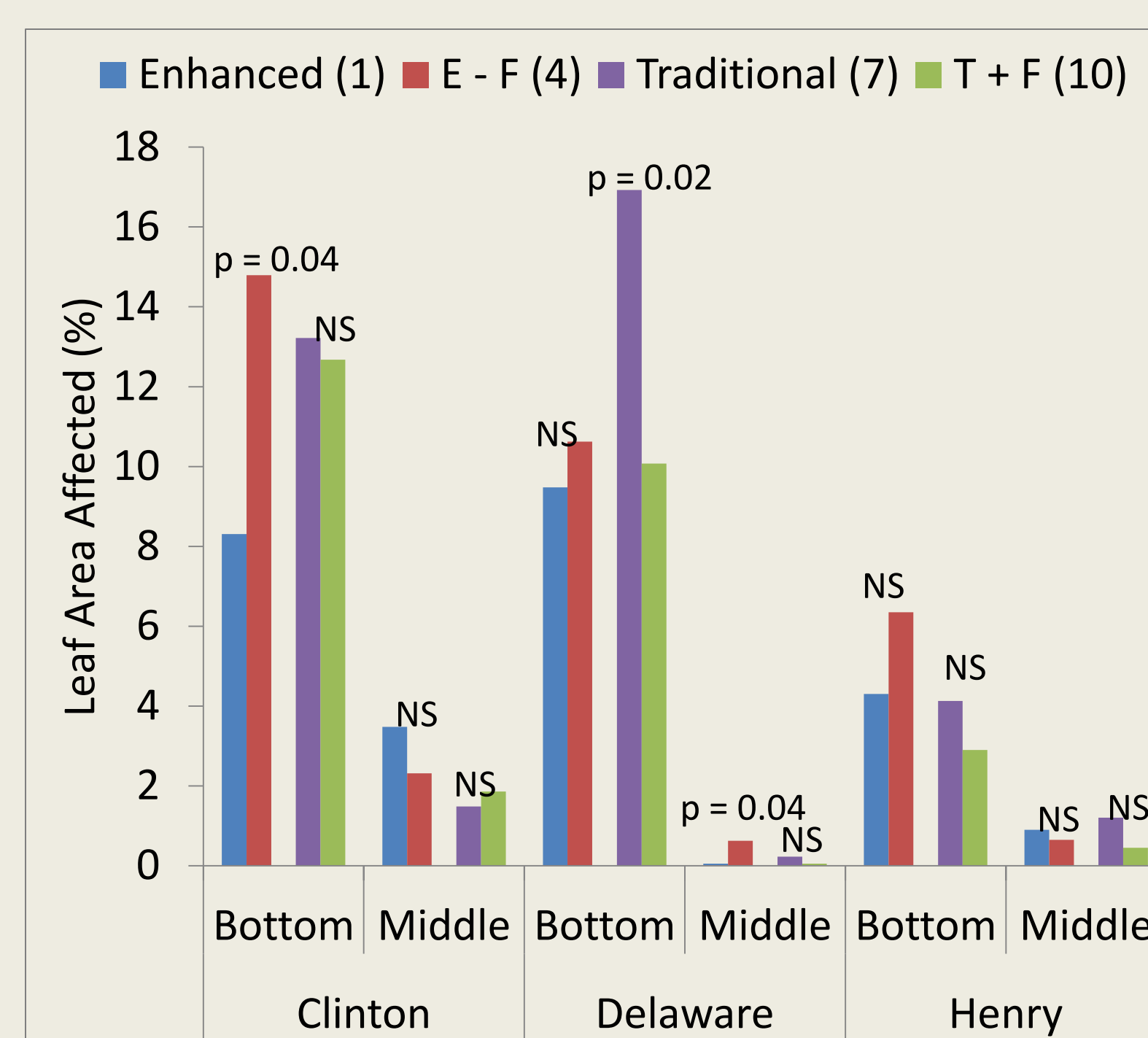


Fig. 4 Brown spot disease ratings two weeks after application (2WAA) at R4 from bottom and middle third of plant canopy.

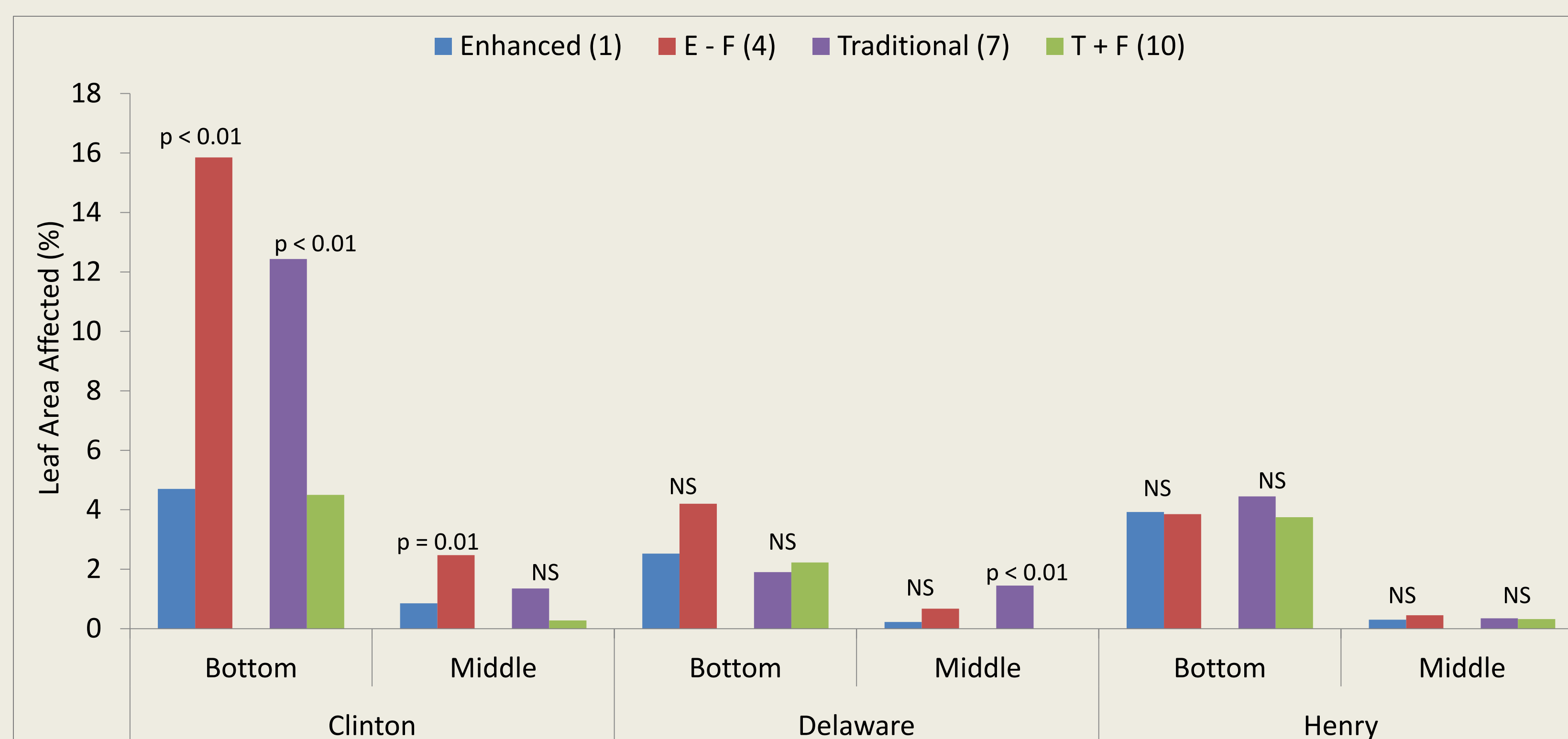


Fig. 5 Brown spot disease ratings four weeks after application (4WAA) at R4 from bottom and middle third of plant canopy.

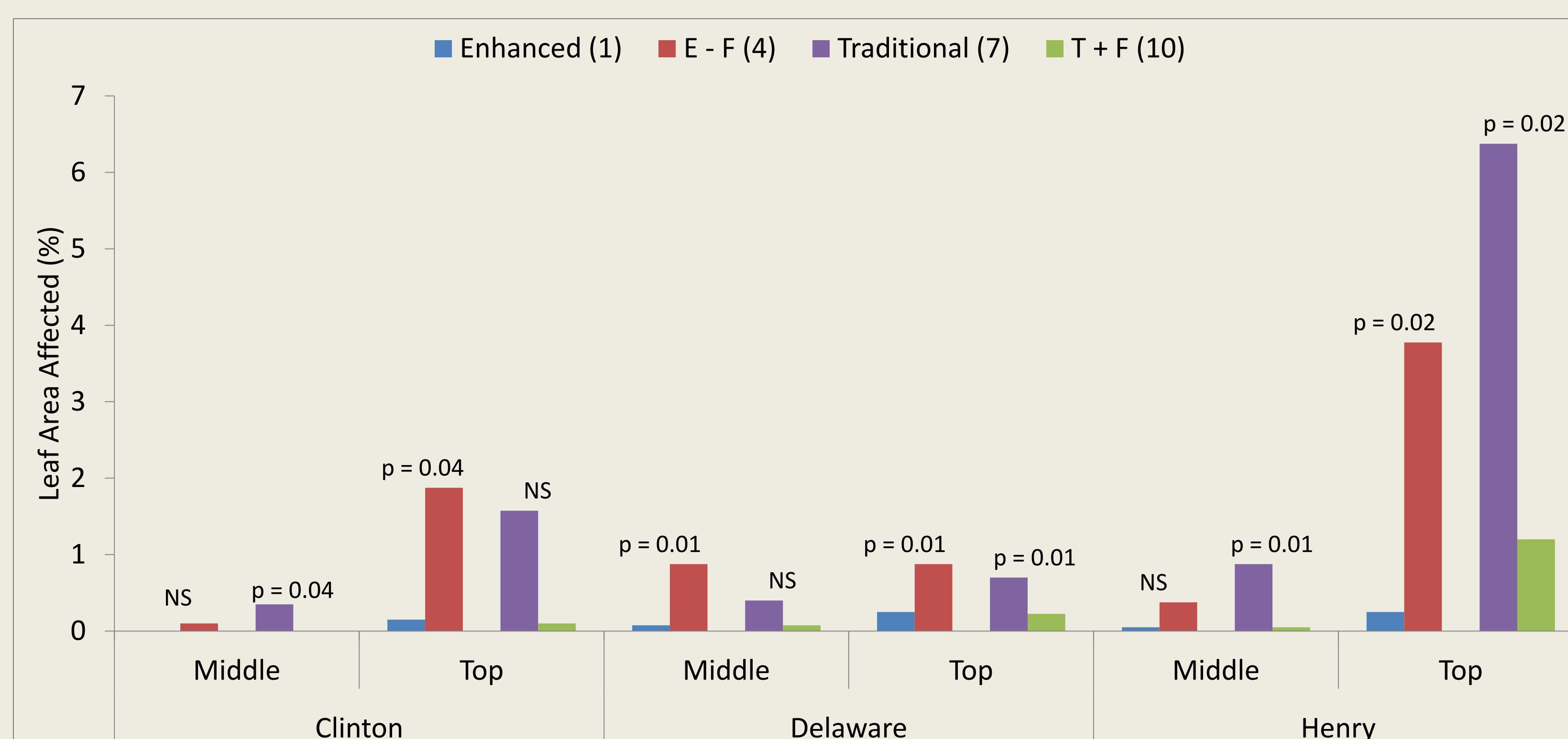


Fig. 6 Frogeye disease ratings four weeks after application (4WAA) at R6 from middle and top third of plant canopy.

Results

Fluorescence Ratio:

Fluorescence ratios for all sites were not statistically significant before fungicide application or 4WAA (Fig. 1, Fig. 2, Fig. 3). At 2WAA, the fluorescence ratio was not statistically significant for two of three sites (Fig.1, Fig. 2) and was statistically significant for Enhanced vs. E - F at the Henry County site (Fig. 3).

Fluorescence ratios close to 1 indicate the plant has high quantum yield. For the statistically significant treatment (Fig. 3), the fluorescence ratio was higher in the enhanced treatment and lower for the treatment that did not receive fungicide application.

Disease Presence:

At 2WAA, brown spot disease ratings were significant for Clinton County in the bottom third of the plant canopy for Enhanced vs. E - F and for Delaware County in the bottom and middle third of the plant canopy for Traditional vs. T + F and Enhanced vs. E - F, respectively. The treatments that received fungicide application had lower disease presence than the treatments that did not.

At 4WAA, brown spot disease ratings were significant for Enhanced vs. E - F and Traditional vs. T + F in the bottom third of the plant canopy at Clinton County, Enhanced vs. E - F in middle third of the plant canopy at Clinton County, and Traditional vs. T + F in middle third of the plant canopy at Delaware County (Fig. 5). Treatments receiving fungicide had lower disease ratings than those that did not.

At 4WAA, frogeye leaf spot disease ratings were significant for 67% of location/measurement timings for the middle and top third of the plant canopy (Fig. 6). Treatments receiving fungicide had lower disease ratings than those that did not.

Conclusions

For fluorescence ratio following fungicide application, no significance was present at eleven out of twelve of the location/measurement timings. A significantly higher fluorescence ratio was observed in fungicide-treated plants in one of twelve location/measurement timings, indicating for that timing that the fungicide treatment resulted in a reduced stress level.

For all disease ratings, 42% of location/measurement timings were significant. The treatments where fungicide was applied had a lower rate of disease presence than the treatments that did not have fungicide application. This indicates pyraclostrobin reduced the rate of brown spot and frogeye disease presence.

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