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Abstract

Alfalfa hay yield reduction in the irrigated low desert of the southwest is usually caused due to the damage instigated from alfalfa aphid complex. Field experiments were conducted in 2015 and 2016 at the University of Arizona, Maricopa Agricultural Center to study the economic threshold; and evaluate the efficacy of various insecticides against alfalfa aphids. Alfalfa hay yield loss in the untreated check was 0.38 tons, amounted \$60.80 per acre loss; and the seasonal average of aphids was 2 BAA & 8 PA per stem, and 20 BAA & 70 PA per sweep on the untreated check, respectively. All insecticide treatments had fewer and for some significantly fewer Aphids than the untreated plots during the whole experimental period for the efficacy trials.

Introduction

The four species of aphids that are of concern to alfalfa growers in the southwestern U.S. are the pea aphid (*Acyrtosiphon pisum* Harris), blue alfalfa aphid (*A. kondoi Shinji Kondo*), the spotted alfalfa aphid (*Therioaphis maculata* Buckton), and the cowpea aphid (*Aphis craccivora* Koch). Insecticide applications often needed and are commonly used to maintain these pest population densities below damaging levels. The efficacy of current collection of broad spectrum insecticides against alfalfa aphid complex in general and blue alfalfa aphids in particular is declining. Economic thresholds currently in use for alfalfa aphids in the low desert of the southwest apparently are based on scanty experimental evidence. In order to address those concerns of stakeholders, the University of Arizona Cooperative Extension Field crops/IPM is leading this project in collaboration with the University of California – Davis and Utah State University to evaluate the efficacy of selective alternative chemicals in replacing broad-spectrum pesticides to manage aphids; and to determine economic thresholds for PA and BAA.

Methods and Materials

Various insecticidal materials and/or rates were applied to individual plots (1) to produce gradations in pea aphid and blue alfalfa aphid populations to study economic threshold; and (2) to study the efficacy of various insecticides against aphids population in alfalfa. The experimental design was RCBD using four replicates for each treatment, with eight insecticide treatments and an untreated check. Plots measured 25 ft. by 20 ft. with 5 ft. alleys between plots. Aphids Populations were counted on five randomly obtained alfalfa stems from each plot and expressed on per stem basis every week starting a week after treatment until the trials terminated. Collection of five 180° sweep sample was included in economic threshold study. A mechanical yield of 75 sq. ft. was harvested from the middle of each plot using Carter™ harvester and Fresh yields calculated to hay yield from its moisture content and dry matter percentage. Statistical analyses were conducted using JMP 11 software.

Results

ECONOMIC THRESHOLD TRIAL: Plots treated with insecticides had fewer pea aphid-days than did the untreated plots (Figure 1). The alfalfa yield loss in the untreated check was 0.38 tons per acre, a loss amounted \$60.80 per acre, based on \$160 / hay ton. Cumulative BAA-days/stem and PA-days/stem as well as per sweep showed negative linear relationships with dry-matter yield (Figure 2 & 3).

EFFICACY TRIAL: Significant differences in cumulative pea and blue alfalfa aphid population and over all aphids' population resulted from the insecticidal treatments (Figure 4 & 5). Cumulative all aphids'-days/stem followed the same pattern as of the cumulative PA per stem (Figure 6)

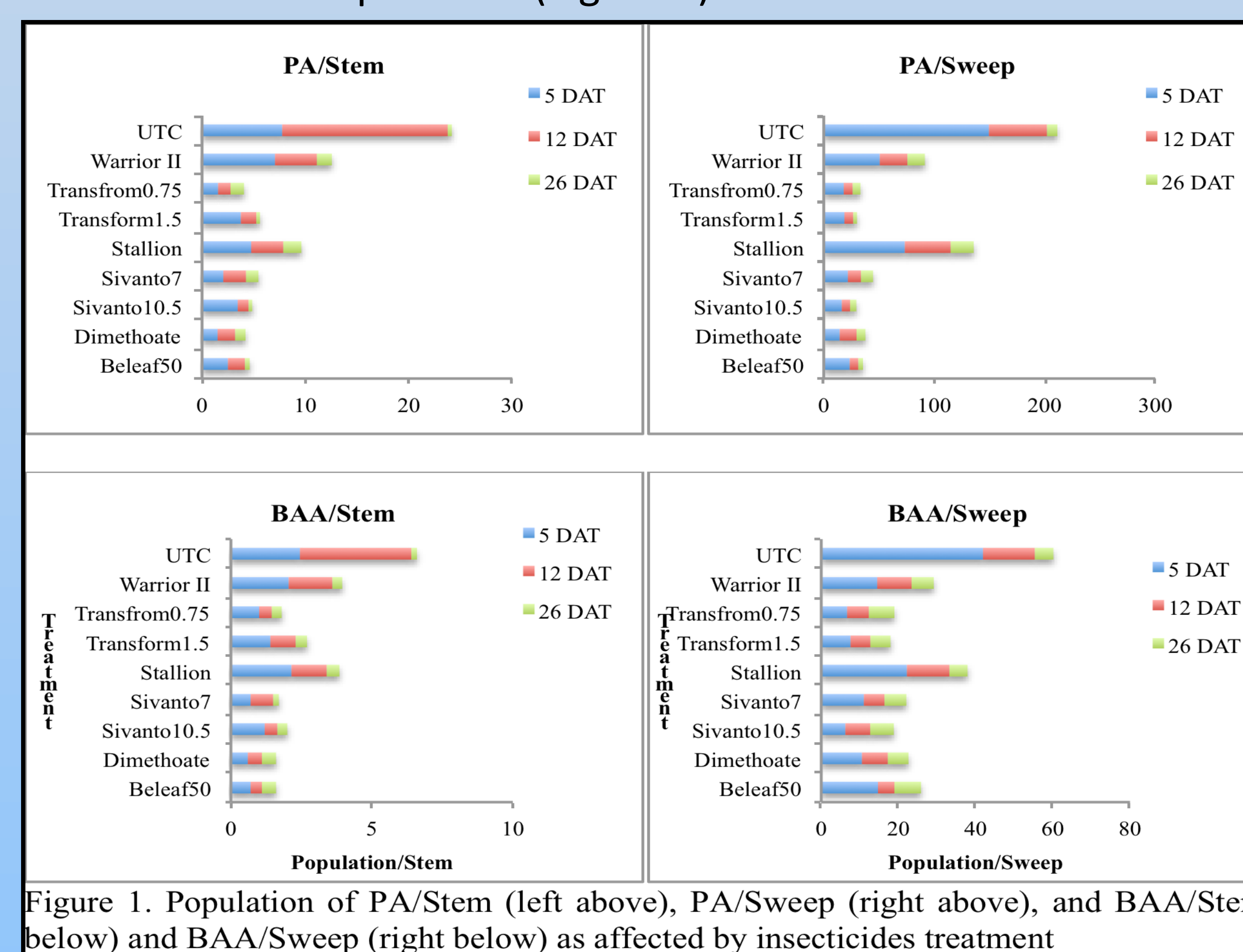


Figure 1. Population of PA/Stem (left above), PA/Sweep (right above), and BAA/Stem (left below) and BAA/Sweep (right below) as affected by insecticides treatment

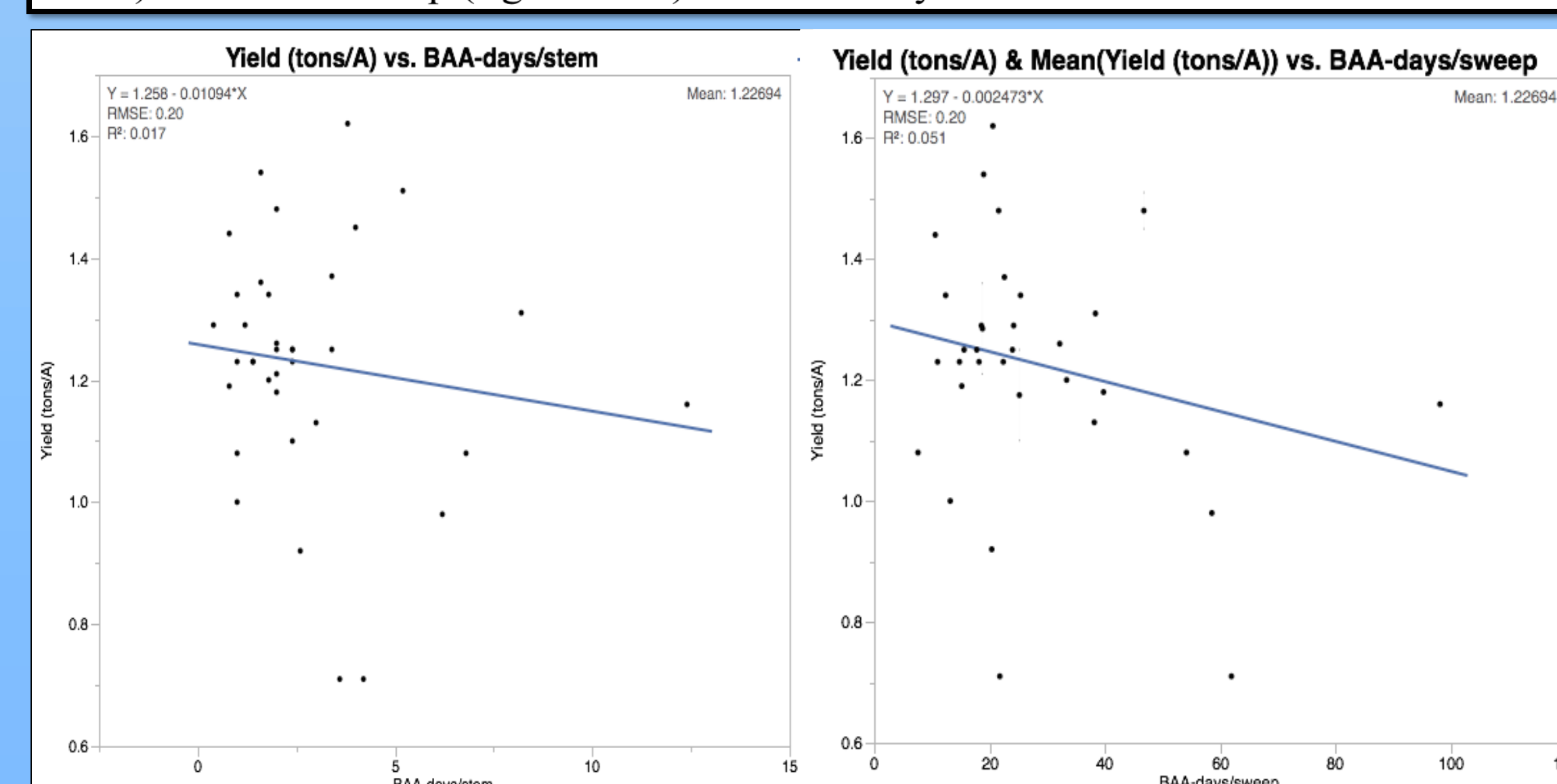


Figure 2. Alfalfa Dry matter Yield in relation to cumulative Blue Alfalfa Aphid (BAA)/stem (right); $Y = 1.258 - 0.01094x$, RMSE = 0.20, $R^2 = 0.017$; and BAA/Sweep (left); $Y = 1.297 - 0.002473x$, RMSE = 0.20, $R^2 = 0.051$

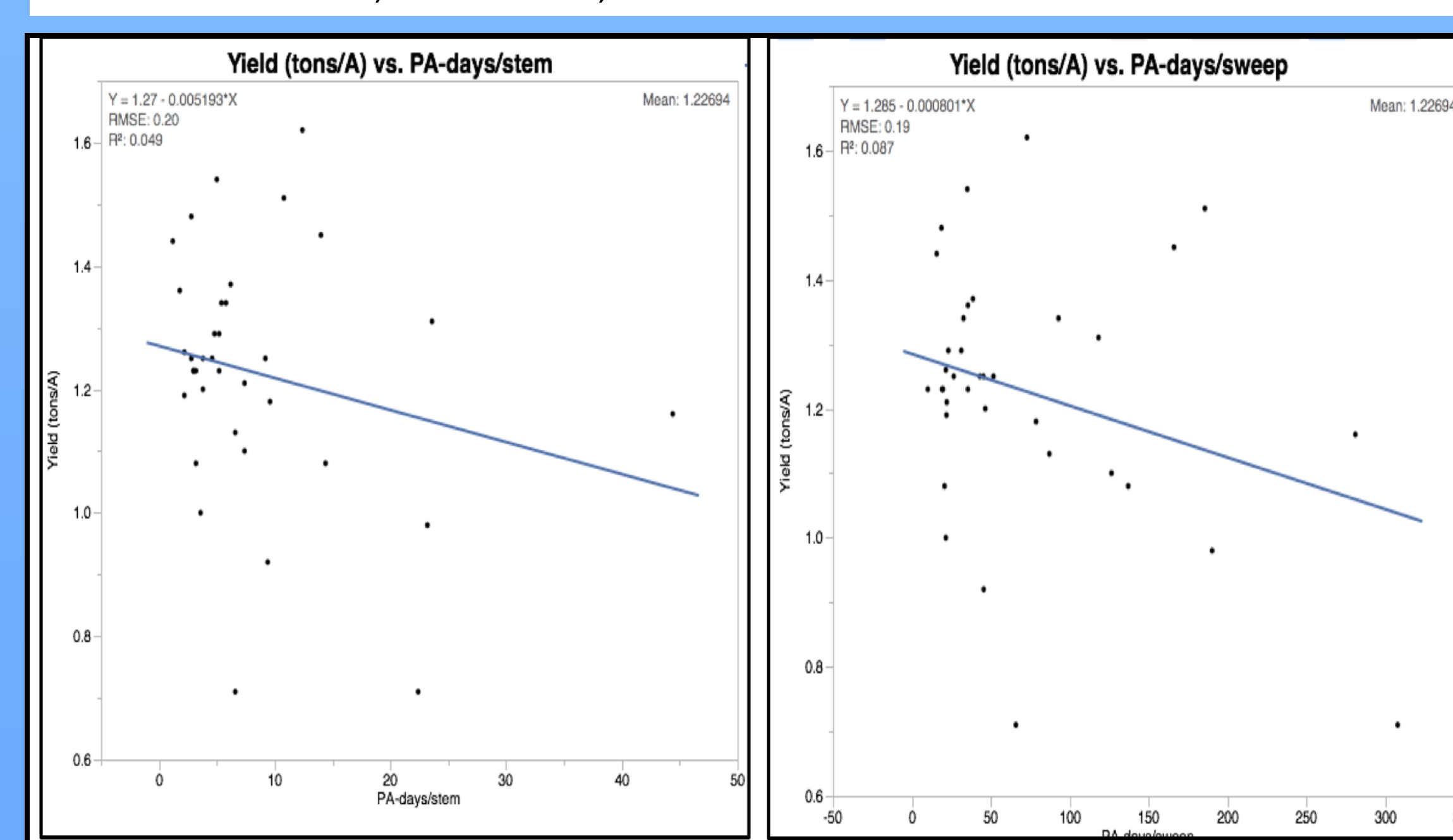


Figure 3. Alfalfa Dry matter Yield in relation to cumulative Pea Aphid (PA)/stem (right); $Y = 1.27 - 0.005193x$, RMSE = 0.20, $R^2 = 0.049$, and per sweep (left) $Y = 1.285 - 0.000801x$, RMSE = 0.19, $R^2 = 0.0087$

Conclusion

Plots treated with insecticides had significantly fewer pea and blue alfalfa aphids and resulted in significantly higher yields than did the untreated control plots both at per stem and per sweep levels in economic threshold trial. Generally, plots treated with Sivanto™ and Transform™ exhibited greater yield. Alfalfa hay yield gain of 0.29 -0.55 tons per acre recorded on the treated plots and corresponding dollar value of \$46.4-\$88.00 per acre at alfalfa hay price of \$160/ton in the April 2015. In the efficacy trial, all insecticide treatments had fewer and for some significantly fewer aphid complexes than the untreated plots during the whole experimental period which resulted in higher alfalfa hay yield.

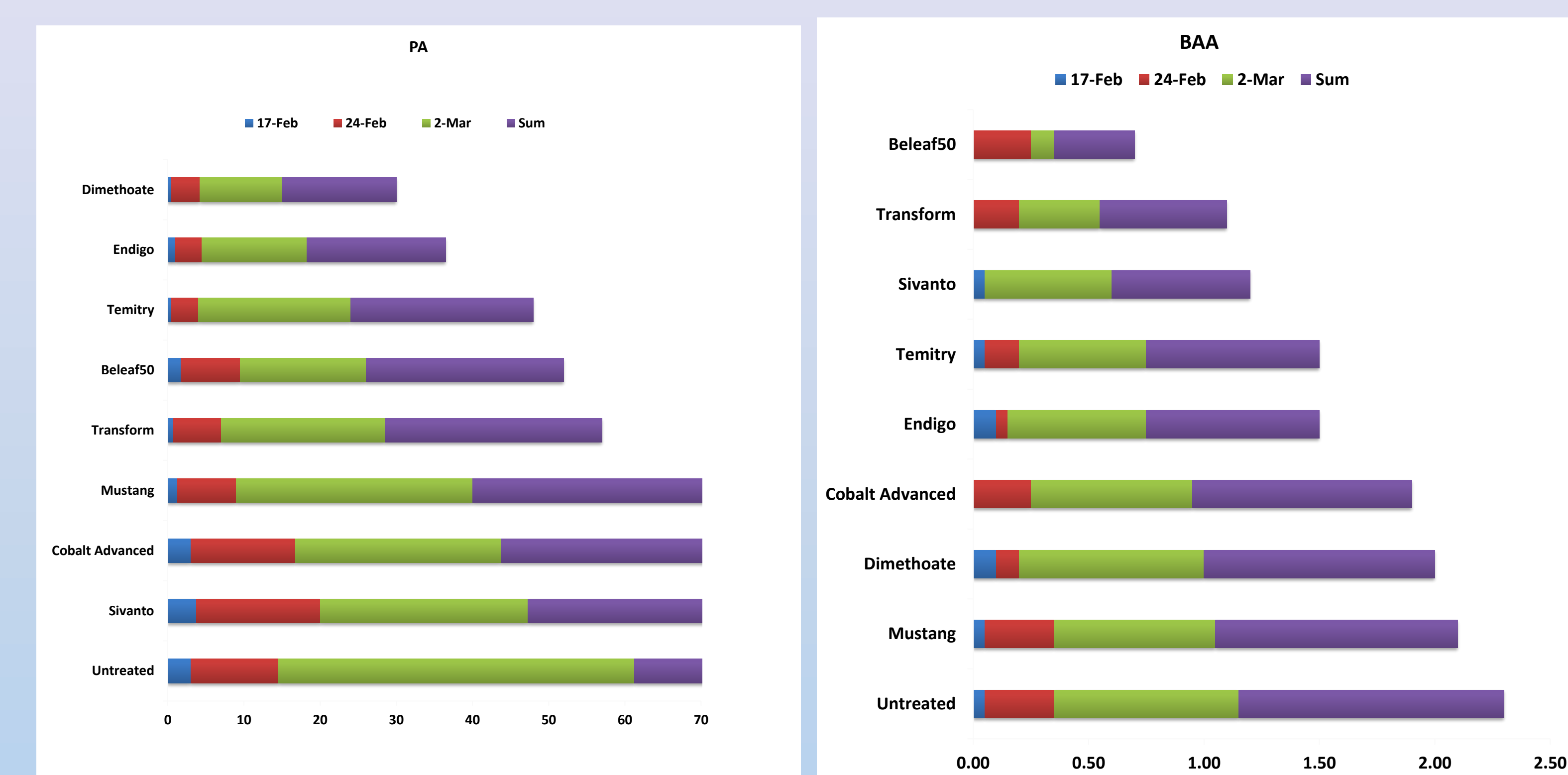


Figure 4. Population of Aphids per stem at three sampling dates in the 2016 insecticide efficacy trial at Maricopa Agricultural Center; PA-Pea aphids, BAA-Blue alfalfa aphids,

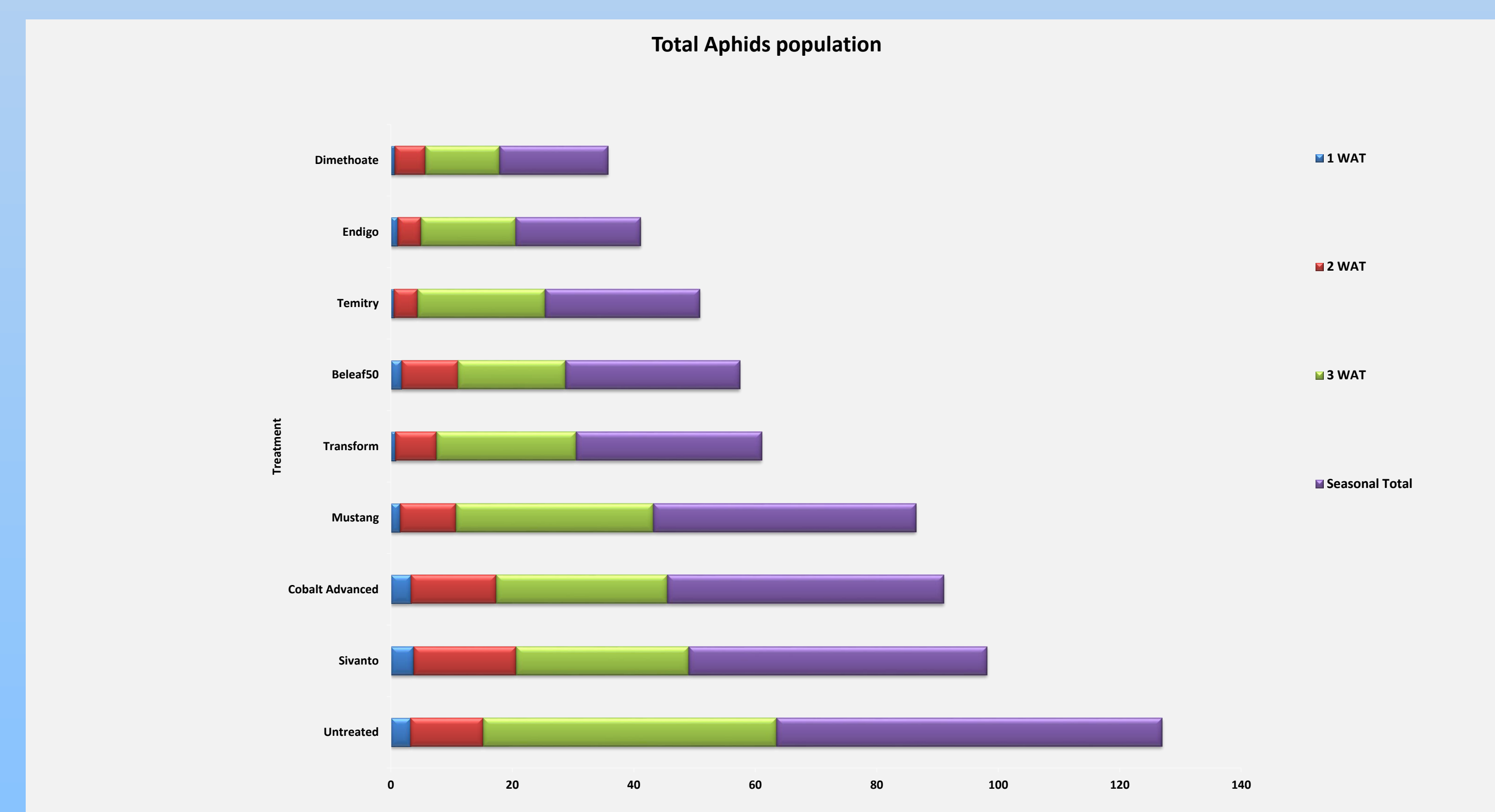


Figure 5. Population of Aphids per stem as a function of times in the 2016 insecticide efficacy trial at Maricopa Agricultural Center; WAT-Weeks after treatment.

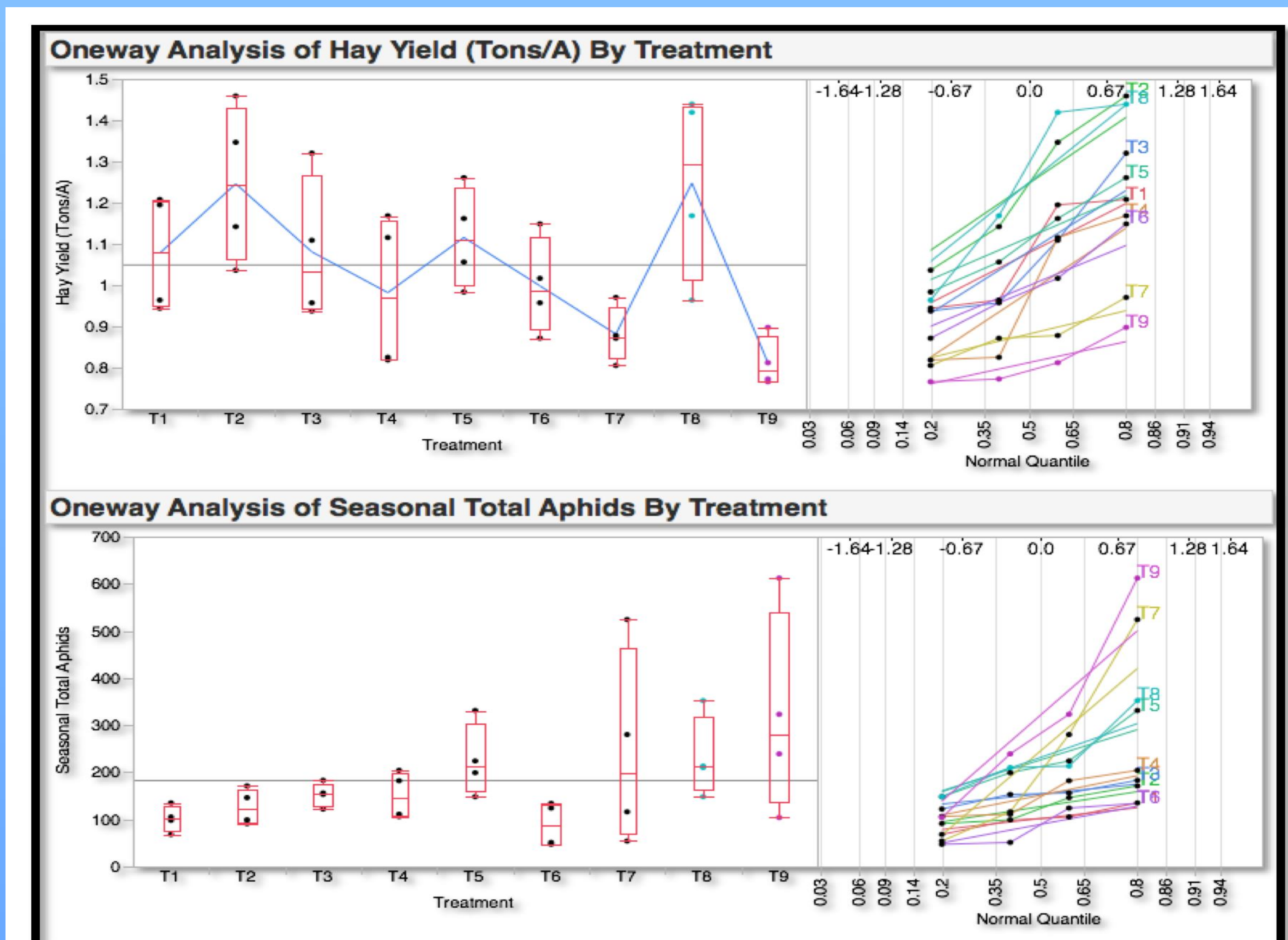


Figure 5. The negative linear relationships of cumulative pea aphids'-days/stem with dry-matter yield