Defoliation of Pima and Upland Cotton at the Safford Agricultural Center, 1993

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Abstract

Experiments were effected on both Pima and upland cotton to compare the defoliation effects of Ginstar, Starfire and sodium chlorate with an untreated check. Weather conditions after treatment applications were recorded and observations taken after one week and two weeks. Grab samples were taken from the picker to determine percent trash and to run HVI analyses.

Introduction

Defoliation of cotton plants prior to harvest is a practice introduced many years ago to reduce leaf trash in the harvested cotton. At higher elevations defoliation is practiced by a smaller percentage of the growers than other parts of the state because cool temperatures at harvest time reduces the effectiveness of many of the chemicals used as defoliants and frost can effectively defoliate the plants with no cost. This study was initiated in 1991 on Pima cotton, and this year was expanded to include upland cotton as well. The objective of the study was to see how effective each of the defoliation treatments was under the prevailing weather conditions present this year.

Materials and Methods

The study was implemented on two small fields planted to Pima S-6 and upland variety DP 90. Treatments were applied to plots 4 rows wide and approximately 50 feet long, in a replicated randomized complete block design. The following crop history indicates the cultural practices employed in the experiment:

<u>Crop history - Pima cotton</u>

Soil type: Grabe clay loam
Previous crop: Cotton
Tillage: Ripped, disced 3 times, bedded
Planting date: 1 April, 1993 Rate: 25 lbs/ac
Herbicide: Treflan, preplant incorporated
Fertilizer: 208 lbs/ac urea side dressed 10 June, 104 lbs/ac urea side dressed 16 Aug
Irrigation: Watered up plus 6 irrigations (23 ac in) Last date: 27 September
Rain: 6.3 inches during the season Last major event: 31 August (2.5 inches)
Defoliation date: 15 October
Heat units after defoliation: 1 week - 57, 2 weeks - 125
Harvest: 1st pick: 10 November 2nd pick: 23 November

Crop history - upland cotton

Soil type: Guest clay/Pima clay loam variant
Previous crop: Barley
Tillage: Disced 3 times, bedded
Planting date: 2 April, 1993 Rate: 25 lbs/ac
Herbicide: Treflan, preplant incorporated
Fertilizer: 108 lbs/ac urea side dressed 10 June and again on 16 August
Irrigation: Watered up plus 5 irrigations (20 ac in) Last date: 29 July
Rain: 6.3 inches during the season Last major event: 31 August (2.5 inches)
Defoliation date: 15 October
Heat units after defoliation: 1 week - 57, 2 weeks - 125
Harvest: 1st pick: 10 November 2nd pick: 23 November

One week after the defoliation each plot was evaluated to determine the amount of leaf drop, the green leaves remaining and the percentage of leaves desiccated and frozen on the plants. The plots were harvested twice to determine if the defoliation caused any boll opening. Grab samples were taken from two of the replicates to determine if the defoliants had any effect on trash content in the lint.

Results and Discussion

Weather is a large factor affecting how well defoliants work. Figure 1 shows the daily heat units, temperatures and wind speeds for two weeks after the defoliant treatments were applied. It can be noted that right after the applications, a cold front moved through lowering temperatures and heat units. By the 23rd of October temperatures had warmed back up, but blustery winds on the 26th ushered in the next cold front. Silvertooth, et.al. (1992), indicated that >200 heat units were needed in the two weeks following defoliation to aid the abscission process; that would mean an average of 14.3 heat units per day for optimum results. It can also be noted from Figure 1 that the heat units received averaged much less than that, in fact only averaging 9 heat units per day. The strong winds blowing up to 32 mph were, however, a positive force in the defoliation, removing leaves that were not firmly attached to the plants.

Table 1a and Figure 2 show the defoliation effects observed on the Pima cotton after one and two weeks of the treatment applications. Leaf drop averaged just over 40% after the first week with no significant differences in the % drop. Sodium chlorate and the two Starfire treatments desiccated the leaves more than the other treatments and left more leaves frozen on the plants. After the second week, the Ginstar treatments and the Dropp+DEF+Agridex treatments dropped more leaves than the other treatments. Sodium Chlorate and the Starfire treatments were indistinguishable from the check. Again the effect of leaf desiccation and % frozen leaves was noted on the chlorate and Starfire treatments. The true effect of the treatment will be seen in the amount of trash removed at the gin and the effect pin trash may have on the fiber. For this reason Tables 1b and 1c are included. One should also look in these two tables to see if yield, maturity (as indicated by the % 1st pick), or fiber characteristics might be changed by the defoliating chemicals. The high rate of Ginstar had the highest lint yield, which could be related to its relatively high percent lint turnout which in turn was effected by the lower percent large trash loss in the ginning. This yield increase was, however, accompanied by a decrease in the % 1st pick. The Starfire treatment, which resulted in the highest % frozen leaves, had the smallest amount of large trash removed at the gin. No trash values were obtained from the classing office for the long staple samples. Much information was tabulated for the effect of defoliation on long staple cotton in this trial, and many statistically significant differences are shown, but little of it gives a compelling reason to chose one treatment over another. Costs of the treatments are a factor not considered in this study and must be evaluated to put things in their true perspective.

Comparing this study to that of 1992 (reference 2), the three rates of Ginstar fell in the same order. Differences were seen in the values of the check and the chlorate treatment between the two years and are probably a result of the weather differences.

The information on the short staple study is found in Tables 2a, 2b and 2c. Observations made one week after the defoliants were applied showed differences in the % leaf drop, with the high rate of Ginstar being the best and the low rate of Ginstar being the worst. As with the long staple test, the desiccating effects of chlorate and Starfire are noted in the decrease in % of green leaves and the number of leaves frozen on plants. After the second week, all of the treated plots showed improvement over the untreated check in the percent of dropped leaves and percent of green leaves. It is also noted that Starfire had more leaves frozen on the plants than any of the other treatments. From Table 2b, the Starfire samples had more large trash than the other samples and a percent lint turnout significantly lower than the middle Ginstar value and the untreated check had the lowest value. Following to Table 2c, the Starfire + chlorate treatment, which had the highest percent large trash also had the highest HVI trash value. The check, however, which had the lowest large trash percent did not have the lowest HVI trash value. Again, many data points were produced but not enough information is known to properly interpret them.

Data found in Tables 2b and 2c are confounded by the fact that in the ten day interval between the last observation and the first picking, five days had minimum temperature of 32 or 31 degrees. This may have caused more defoliation to take place, particularly in the check plot. A more timely harvest might make it easier to interpret the data.

References

1. Silvertooth, J.C., S.H. Husman, S.W. Stedman, P.W. Brown, and D.R. Howell. 1992. Defoliation of Pima cotton, 1991. Cotton, A College of Agriculture Report, The University of Arizona, Tucson, AZ. Series P-91, pp.289-301.

2. Clark, L.J., E.W. Carpenter and P.N. Odom. 1993. Defoliation of Pima cotton at the Safford Agricultural Center, 1992. Cotton, A College of Agriculture Report, The University of Arizona, Tucson, AZ. Series P-94, pp.66-72.

Table 1a. Defoliation observations on long staple cotton on the Safford Agricultural Center, 1993.

Treatment	1st Week			2nd Week		
	% Drop	% Green	% Frozen	% Drop	% Green	% Frozen
Check	40.0 a	48.8 a	11.3 c	92.8 bcd	5.5 a	1.8 bc
Ginstar 0.075 lb/ac	41.3 a	48.8 a	10.0 c	95.5 abc	3.8 ab	0.8 c
Ginstar 0.1 lb/ac	43.8 a	36.3 abc	17.5 bc	95.5 abc	2.3 b	1.5 bc
Ginstar 0.15 lb/ac	36.3 a	46.3 ab	15.0 c	96.3 ab	1.8 b	2.0 bc
Dropp+DEF+Agridex	47.5 a	38.8 abc	13.8 c	96.5 a	2.5 b	1.0 c
Sodium Chlorate (2g)	45.5 a	13.8 d	40.8 a	92.8 bcd	3.8 ab	3.5 abc
Starfire (12oz) + Sodium chlorate (2 g)	41.3 a	26.3 bcd	32.5 ab	90.3 d	5.5 a	4.3 ab
Starfire (12oz)	42.5 a	18.8 cd	38.8 a	92.0 d	3.0 ab	5.0 a
Average	42.5	34.7	22.4	93.9	3.5	2.5
LSD(05)	15.5	19.4	15.9	3.20	2.38	2.59
CV(%)	25.0	49.7	68.3	3.1	55.7	87.8

Table 1b. Yield and other agronomic values for a defoliation study on long staple cotton on the Safford Agricultural Center, 1993.

Treatment	Lint Yield	Percent 1st Pk	Percent Lint	Percent Large Trash	Plant Height	Plants Population
Check	632 a	82.6 bc	38.0 bc	6.60 a	32.0 ab	25410 a
Ginstar 0.075 lb/ac	568 cd	87.6 a	38.7 ab	4.45 ab	29.8 ab	24503 a
Ginstar 0.1 lb/ac	602 bcd	84.2 ab	38.2 bc	5.75 ab	30.0 ab	22234 a
Ginstar 0.15 lbs/ac	751 a	79.0 c	38.8 ab	3.9 b	30.5 ab	26544 a
Dropp+DEF+Agridex	539 d	82.5 bc	37.2 c	5.65 ab	28.3 b	24956 a
Sodium chlorate (2 gal/ac)	641 bc	83.5 abc	38.0 bc	4.25 ab	34.8 a	24503 a
Starfire (12oz) + Sodium chlorate (2g)	682 ab	83.8 ab	39.3 a	5.75 ab	29.8 ab	28133 a
Starfire (12oz)	608 bcd	85.2 ab	38.2 bc	3.75 b	29.5 ab	23368 a
Average	627.9	83.6	38.3	5.01	30.6	24956.3
LSD(05)	88.2	4.32	0.94	2.11	4.82	5903.7
CV(%)	13.2	4.3	2.3	31.7	12.7	17.9

Table 1c. HVI values for a defoliation study on long staple cotton on the Safford Agricultural Center, 1993.

Treatment	Micronaire	Length	Strength	Uniformity	Grade
Check	41.5 abc	134.5 abc	40.2 ab	86.0 a	3 b
Ginstar 0.075 lb/ac	42.0 ab	133.5 bc	38.8 bc	85.5 a	3 b
Ginstar 0.1 lb/ac	40.5 c	135.5 abc	42.2 a	86.5 a	3/4 a
Ginstar 0.15 lbs/ac	43.0 a	131.5 c	38.3 bc	85.0 a	3 b
Dropp+DEF+Agridex	41.0 bc	138.0 a	39.6 ab	86.0 a	3 b
Sodium chlorate (2 gal/ac)	43.0 a	135.0 abc	40.9 ab	85.5 a	3 b
Starfire (12oz) + Sodium chlorate (2g)	42.5 ab	135.5 abc	38.0 bc	85.0 a	2/3 c
Starfire (12oz)	41.5 abc	137.5 ab	36.5 c	86.5 a	3 b
Average	41.88	135.13	39.29	85.75	3
LSD(05)	1.57	3.66	2.71	1.57	0.39
CV(%)	3.2	2.1	6.2	1.2	12.0

Table 2a. **Defoliation observations on short staple cotton on the Safford Agricultural Center, 1993.**

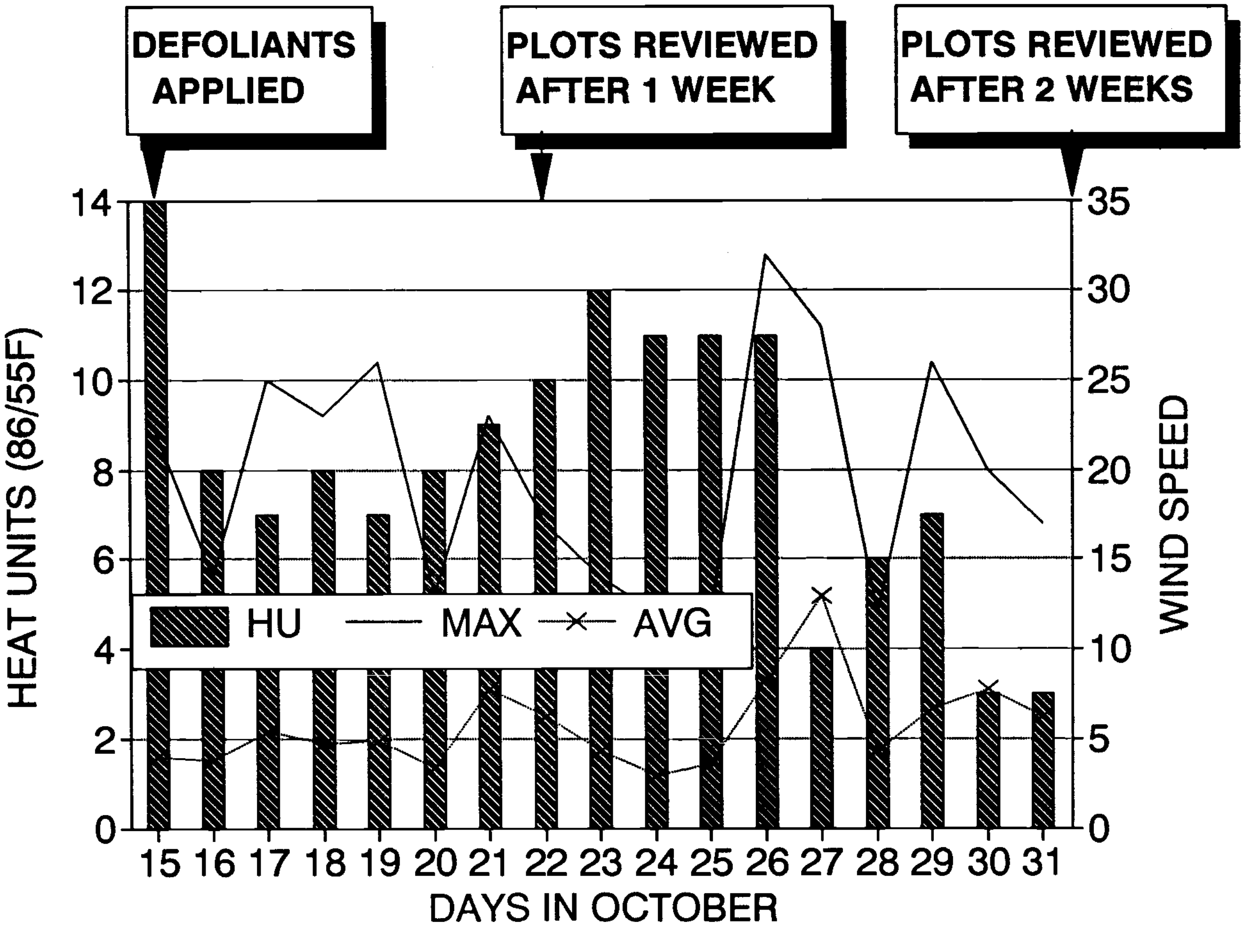
Treatment	1st Week			2nd Week		
	% Drop	% Green	% Frozen	% Drop	% Green	% Frozen
Check	23.8 b	72.5 a	3.8 d	25.0 b	72.5 a	3.8 b
Ginstar 0.075lb/ac	22.5 b	77.5 a	0.0 d	78.8 a	18.3 b	3.0 b
Ginstar 0.1 lb/ac	23.8 b	71.3 a	5.0 d	80.0 a	16.3 b	3.8 b
Ginstar 0.15 lb/ac	32.5 a	67.5 a	0.0 d	85.8 a	9.5 b	4.8 b
Dropp+DEF+Agridex	30.0 ab	46.3 b	23.8 c	76.3 a	20.0 b	3.8 b
Sodium Chlorate (2g)	27.5 ab	31.3 c	43.8 b	74.5 a	18.3 b	7.3 b
Starfire (12oz) + Sodium chlorate (2 g)	30.0 ab	22.5 cd	47.5 b	73.8 a	6.3 b	20.0 a
Starfire (12oz)	26.3 ab	12.5 d	61.3 a	78.8 a	3.8 b	17.5 a
Average	27.0	50.2	23.1	71.6	20.6	7.9
LSD(05)	7.24	10.4	10.4	17.8	15.3	7.5
CV(%)	20.9	49.8	104.5	29.7	111.5	97.2

Table 2b. **Yield and other agronomic values for a defoliation study on short staple cotton on the Safford Agricultural Center, 1993.**

Treatment	Lint Yield	Percent 1st Pk	Percent Lint	Percent Large Trash	Plant Height	Plants Population
Check	1174 a	89.1 a	35.0 abc	6.60 b	49.5 a	25864 a
Ginstar 0.075 lb/ac	1198 a	83.1 abc	35.2 ab	7.50 ab	50.8 a	19511 a
Ginstar 0.1 lb/ac	1203 a	82.2 abc	35.7 a	7.30 ab	46.8 a	23822 a
Ginstar 0.15 lbs/ac	1084 a	86.5 ab	34.5 abc	8.20 ab	49.8 a	27225 a
Dropp+DEF+Agridex	1119 a	82.8 abc	35.3 ab	6.85 ab	46.8 a	22461 a
Sodium chlorate (2 gal/ac)	938 a	78.4 c	33.6 c	7.80 ab	46.0 a	18831 a
Starfire (12oz) + Sodium chlorate (2g)	1133 a	81.5 bc	33.9 bc	8.75 a	51.3 a	24276 a
Starfire (12oz)	1018 a	88.8 ab	34.6 abc	8.02 ab	46.5 a	26091 a
Average	1108.0	84.04	34.7	7.65	48.4	23509.9
LSD(05)	244.2	6.63	1.35	1.72	4.97	10829.3
CV(%)	16.2	6.4	3.1	16.3	9.0	31.5

Table 2c. HVI values for a defoliation study on short staple cotton on the Safford Agricultural Center, 1993.

Treatment	Micronaire	Length	Strength	Uniformity	Trash	Grade	Tr Grade
Check	39.5 ab	117.0 ab	29.5 c	82.5 b	7.0 a	31 a	1.5 bc
Ginstar 0.075 lb/ac	39.0 ab	113.5 c	28.7 d	83.0 ab	7.0 a	31 a	1.0 c
Ginstar 0.1 lb/ac	40.5 a	117.0 ab	29.5 c	83.5 ab	6.0 a	31 a	2.5 a
Ginstar 0.15 lbs/ac	41.5 a	114.5 c	29.2 cd	83.5 ab	6.5 a	31 a	2.5 a
Dropp+DEF+Agridex	40.5 a	118.0 a	30.3 a	84.0 a	5.5 a	31 a	1.0 c
Sodium chlorate (2 gal/ac)	37.5 b	116.5 b	29.6 bc	83.5 ab	7.0 a	21/31 b	1.5 bc
Starfire (12oz) + Sodium chlorate (2g)	37.0 b	117.0 ab	30.3 ab	82.5 b	8.0 a	31 a	2.0 ab
Starfire (12oz)	39.0 ab	117.0 ab	30.3 ab	83.0 ab	7.0 a	31 a	1.5 bc
Average	39.31	116.3	29.66	83.19	6.75	31	1.69
LSD(05)	2.47	1.15	0.64	1.15	2.60	3.00	0.63
CV(%)	5.2	1.4	0.99	0.9	25.8	8.1	41.0



TEMPERATURE

MAX	86	75	71	77	74	79	78	79	84	85	83	83	67	73	75	65	68
MIN	52	45	52	44	45	38	45	47	44	37	42	45	45	37	41	40	32

Figure 1. Daily heat units, wind speeds and temperatures for two weeks following defoliation treatment applications on the Safford Agricultural Center, 1993.

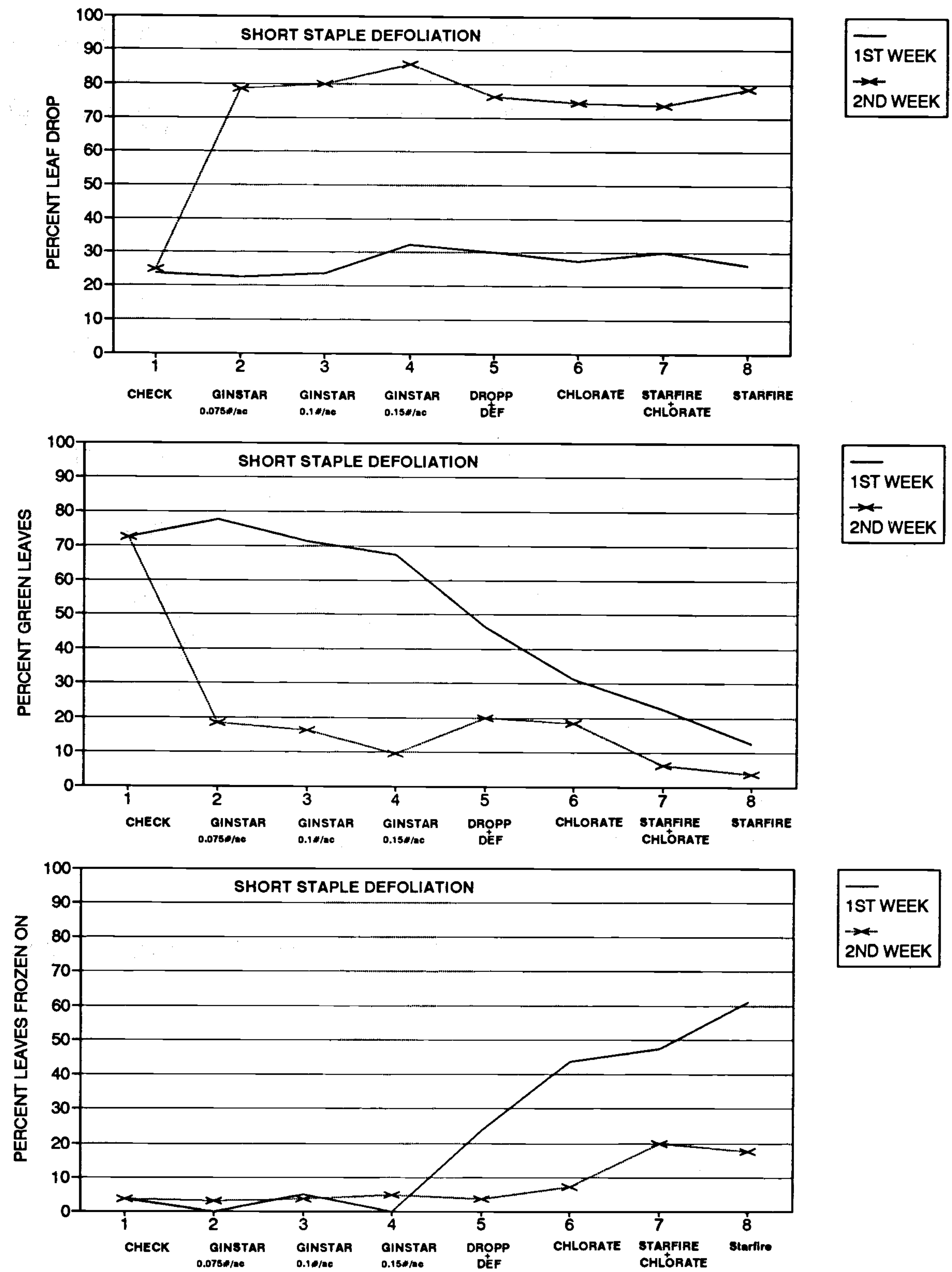


Figure 3. Graphical presentation of data tabulated in Table 2a.

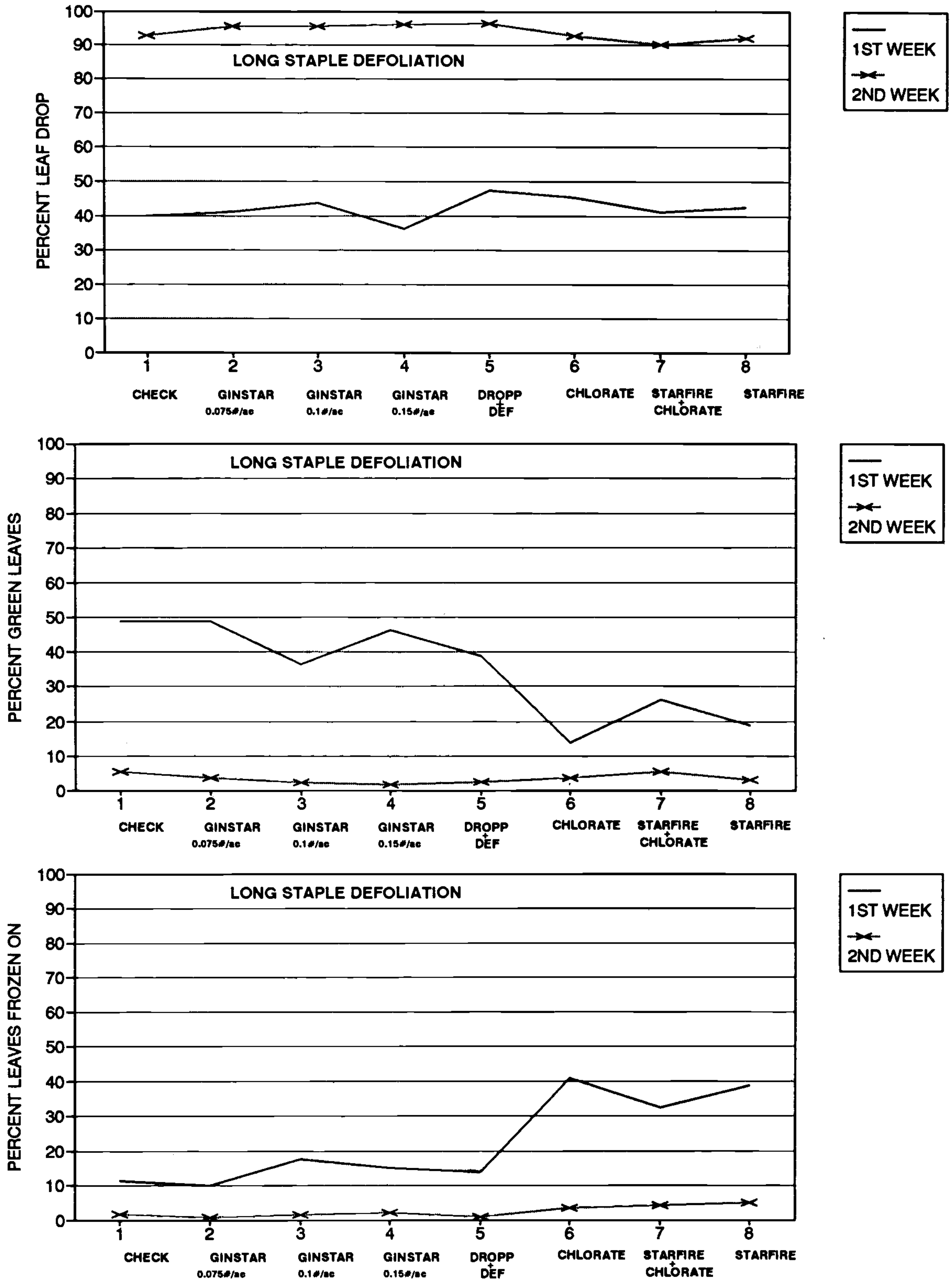


Figure 2. Graphical presentation of data tabulated in Table 1a.