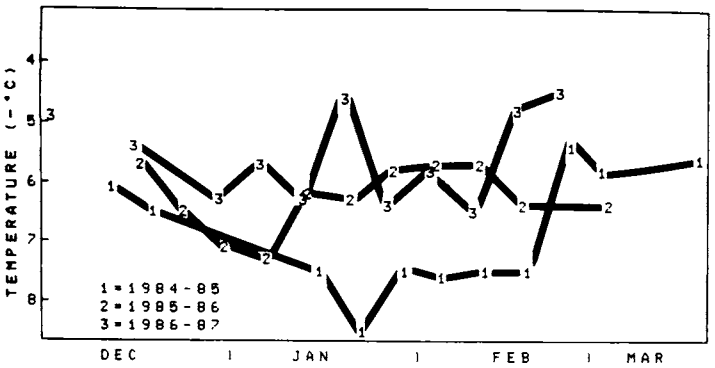

Fig. 7. Killing point temperatures for 'Marsh' grapefruit for 1984-85, 1985-86 and 1986-87.

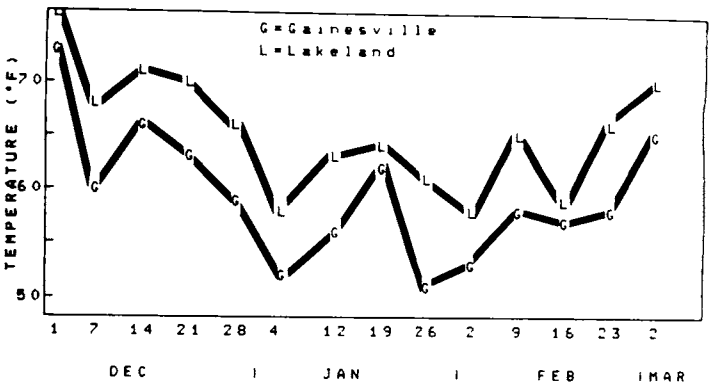

Fig. 8. Weekly mean temperatures in Gainesville and Lakeland for the 1986-87 winter.

result of lower mean air temperatures in Gainesville than in the Lakeland/Highland City area (Fig. 8).

These data and those of earlier reports (3, 4) indicate that air temperatures are a major determinant of leaf KP, and that KP temperatures give a good estimation of temperatures which will damage citrus leaves in the grove. Although the cost and complexity of the KP determination process does not permit the use of this test in individual grove situations, regional KP data can be used in situations when predicted low temperatures approach KP temperatures. We will continue to determine KP and report the data to interested county extension workers and growers. The availability of information about the relative cold tolerance of citrus in the week prior to an expected cold experience could allow for better decisions about the utility of cold protection measures.

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OBSERVATIONS OF CULTURAL PROBLEMS WITH THE 'SUNBURST' MANDARIN

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Abstract. **'Sunburst' mandarin, a progeny of two hybrids of *Citrus reticulata* Blanco and *C. paradisi* Macf. origin, was surveyed in six commercial groves and found to have heavy mite infestations or a previous history of severe mite problems primarily from Texas citrus mite (*Eutetranychus banksi* (McG)) and citrus rust mite (*Phyllocoptruta oleivora* (Ashm.). This resulted in cell destruction in the leaf from spider mite feeding and surface russet from rust mite feeding. Injury was virtually eliminated by more frequent spraying of the foliage with an acaricide during the growing season. Two unusual leaf problems were observed. These included a dark blistering on leaves and stems in every grove which appears to be a latent cellular response to citrus rust mite feeding, and a chlorotic spotting over all the leaf surface was observed in two groves. Higher black scale (*Sassetia neglecta* (Delotto)), aphid, and citrus mealy bug (*Planococcus citri* (Risso)) populations were observed on 'Sunburst' compared to adjacent cultivars in one grove and greater herbicide phytotoxicity occurred on 'Sunburst' in two groves. 'Sunburst' will require more attention than most cultivars, particularly when it comes to mite and insect control as well as herbicide practices.**

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[2]Disorder reported by J. Taylor (Merch Sharp & Dohme Research Labs) and R. Johnson (Consultant).

'Sunburst' is a progeny from the cross of sibling hybrids 'Robinson' and 'Osceola' [*C. reticulata* Blanco x (*C. paradisi*

Macf. x *C. reticulata*)] (4) and was released for commercial use in 1979. 'Sunburst' was reportedly tolerant to snow scale (*Unaspis citri* Comst.) and field resistant to alternaria (*Alternaria citri* Ellis and Pierce) (4); however, recent observations by researchers and growers suggest that this cultivar is an unusually favorable host for mites and may suffer from other problems not common to most other cultivars. Reports of problems were sufficiently frequent to justify a series of observations to determine possible causes. This is a report of those observations which were begun in 1986 and continued into 1987.

Materials and Methods

Several young 'Sunburst' groves were observed for leaf, stem, and fruit damage, as well as presence of mite and insect populations in 1986-87, and those plus other groves were observed on a regular basis throughout the 1987-88 season in the following locations: Davenport, Lake Alfred, Lake Wales, Mt. Dora, and Waverly, Florida. In the Davenport grove, alternate trees on Carrizo citrange (*Poncirus trifoliata* Raf. x *C. sinensis* (L.) Osbeck) in a single row (approximately 30) were sprayed monthly with either fenbutatin (Vendex) or dicofol (Kelthane) until fall, when only fenbutatin was used to avoid buildup of scale from late dicofol use. Commercial treatments in this grove were captafol (difolatan) in March; captafol, ethion, and Zn in May; ethion, Cu, and Zn also in May; ethion, Cu, and oil in July; and ethion in Oct. In Lake Alfred, fenbutatin was used on 29 May and 31 June in 1987. This grove received a nutritional spray on 14 May, dicofol + oil on 8 July, and fenbutatin on 12 November in the regular spray program. The Lake Wales and Waverly groves were observed for new mite buildup every 2 to 3 weeks commencing 4 weeks after each spray. These blocks received dicofol in the spring, fenbutatin or ethion-oil in June, and copper-oil in August. Two other commercial groves near Mt. Dora were observed to evaluate leaf blemishes. These groves received Cu, Zn, and ethion in the spring, oil and ethion in the summer, and carbaryl, chlorpyrifos, and fenbutatin in the fall.

Results and Discussion

Examination of 'Sunburst' trees with severe leaf and fruit damage in 1986 showed that heavy mite populations of both Texas citrus mite and citrus rust mite were present or had been present (cast skins). Damage was much worse than on adjacent 'Nova' (*C. reticulata* Blanco x [*C. paradisi* x *C. reticulata*] or navel (*C. sinensis* L.) trees. By late summer, a serious leaf blistering was also present on spring leaves. Leaves with similar damage were brought in by growers.

In 1987, buildup of mites and damage development were followed on trees that were sprayed regularly. Texas citrus mite populations reached 40+ per leaf. Leaves developed the typical dull, gray-green bleached appearance because of cell content loss (1) from mite feeding (Fig. 1B vs. A). Leaves in Fig. 1A are from trees sprayed monthly with fenbutatin or dicofol. Two sprays of fenbutatin gave adequate mite control until late fall in another block of trees. Two commercial groves also had adequate mite control when the groves were observed for respraying every 2 to 3 weeks starting 4 weeks after the last spray. This resulted in these groves being sprayed 2 to 3 times in 1987. In groves where mites were controlled inadequately. Considerable rust mite damage occurred to leaves (Fig. 1C) and stems of all leaf flushes throughout the year (Fig. 1D), but very little fruit damage was observed in 1987.

On most cultivars, citrus rust mites build up on fruit more than on leaves (5) and fruit damage is more prevalent (2, 5). On 'Sunburst' it appears that injury on leaves and stems is equal to or more serious than on fruit. Yothers and Mason (7) ranked tangerines and mandarins as moderately low in susceptibility to citrus rust mite, but one tangor selection had citrus rust mite buildup during three seasons that was higher than seedling orange or other tested cultivars. Apparently, 'Sunburst' is also a preferred host of citrus rust mite and Texas citrus mite.

Population buildups of black scale, citrus mealy bug, and aphids were observed on 'Sunburst' trees over the 2 years of observation. In one grove, high populations of black scale were found at the stem juncture between last year's growth and the spring flush (Fig. 2A) of 'Sunburst'. Grapefruit in nearby rows did not have as heavy an infestation. Other cultivars of oranges and mandarins did not have scale buildup. 'Sunburst' may be similar to grapefruit as a host preferred by soft scales. It's parentage does include grapefruit (4).

Another indication of 'Sunburst's' sensitivity was the greater phytotoxicity symptoms on leaves from bromacil and diuron (Krovar) observed in the Davenport grove (Fig. 2B). Adjacent navel and 'Nova' had less of the vein clearing symptoms. The 'Sunburst' trees were on Carrizo citrange which is considered a resistant rootstock to this herbicide (3). The phytotoxicity symptoms were more severe in this grove which was near a sand mine and the soil appeared to be unusually low in organic matter (white sand). 'Sunburst' does not appear to be very thrifty on this kind of soil in Florida and all problems are more pronounced.

In 1986 in the Davenport and Lake Alfred groves, a dark blistering was observed on leaves and young stem bark of trees with severe citrus rust mite and Texas citrus mite infestations. This blistering did not occur in 1987 on trees sprayed regularly to control citrus rust mites. On no spray or inadequately sprayed trees, leaves that developed blistering were those that had sufficient citrus rust mite populations to cause some dark surface blemish from feeding (2). The blistering is apparently a latent response to earlier citrus rust mite feeding that is absent or infrequent on other cultivars (2). Blistering was greatest on the petiole and midrib vein. In severe cases, cracks later developed over the leaf midrib. Further studies of this problem are underway.

Leaves with heavy mite populations late in the fall were severely chlorotic along the midrib and larger lateral veins. The damaged areas developed bronzing after the chlorosis and many of the leaves with these symptoms dropped prematurely.

An unexplained leaf disorder was reported[2] in two groves near Mt. Dora. The leaves developed chlorotic spots over the entire leaf (Fig. 2D). On the underside of the leaf, there were small darkened lesions associated with the chlorotic spots. Except for the location of the chlorotic spots, the symptoms were similar to those of boron toxicity or more so to molybdenum deficiency (6). Further study of this problem is anticipated.

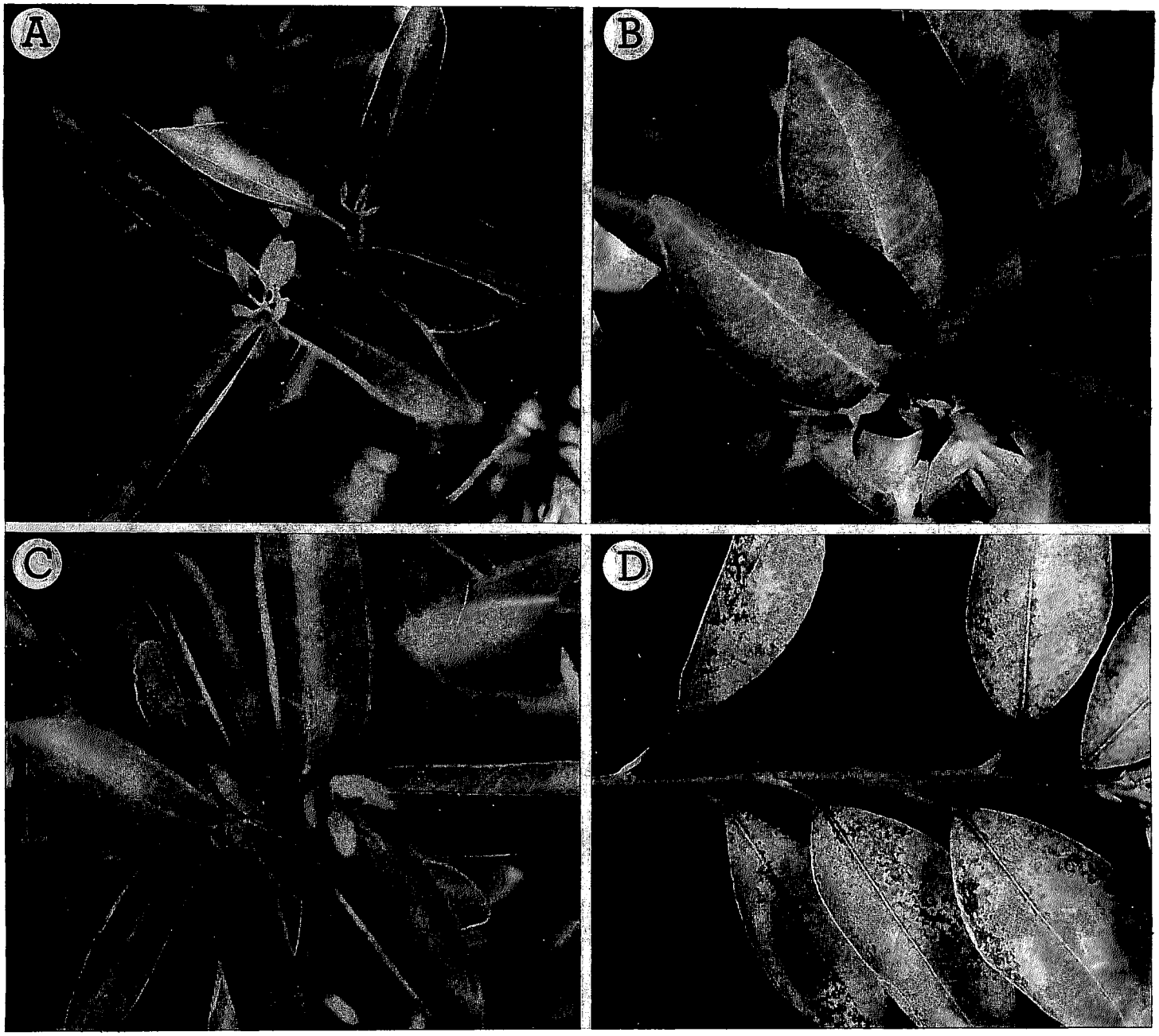

Fig. 1. (A) 'Sunburst' flush sprayed monthly showing no mite damage. (B) Heavy spider mite feeding. (C) Citrus rust mite damage to upper surface and midrib of leaf. (D) Stem damage from citrus rust mite feeding.

Based on our observations during the early years of field growth, 'Sunburst' cultivar may be more sensitive to citrus rust mite, spider mites, and perhaps other insects as well as herbicide phytotoxicity. In later years, these problems may become less severe on older, larger canopied 'Sunburst' trees. When frequent insect and mite control were employed, adequate crop protection was achieved. The value of the crop for fresh fruit sale should justify this effort if it is required. In some cases, three well-timed sprays using good materials were adequate.

Further study of the possible preference of this cultivar or others by citrus rust mite or spider mites is warranted on at least two counts. With restrictions on acaracide use and development of resistance, cultivars more susceptible to mites could hasten the time until mite resistance to an acaracide occurs if more frequent spraying is required or higher populations are present at each spray application. Another long-term concern is an unanswerable question at this point. Do preferred hosts overwinter larger populations of mites and lead to more rapid buildup of mites in following years, thus accentuating host mite preference?

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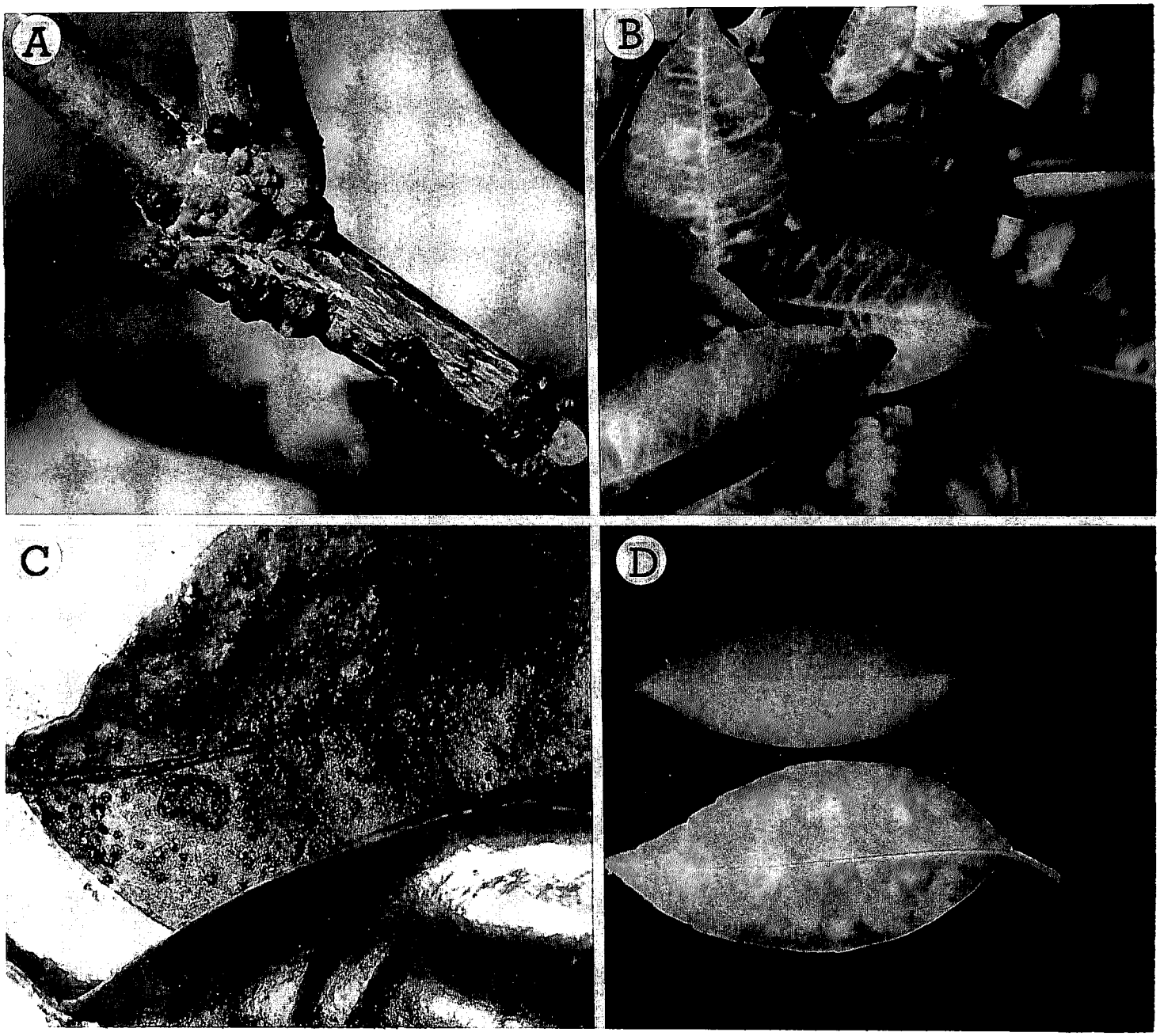

Fig. 2. (A) 'Sunburst' with heavy scale infestation at stem juncture. B) Bromacil and diuron (Krovar) herbicide damage to foliage on tree growing on a white sand soil. (C) Leaf blistering from unknown cause. (D) Leaf chlorosis from unknown cause.

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