Effect of Date of Planting and Irrigation Termination On Pink Bollworm Populations in Pima and Upland Cotton

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ABSTRACT

Field experiments conducted in 1989 comparing effects of planting date and irrigation termination date on pink bollworm in both in-season and overwintering infestations indicated different responses depending upon the location and type of cotton. Tests were located at: Yuma Agricultural Center; Marana Agricultural Center; and Maricopa Agricultural Center. Infestations at Yuma ranged from 0% at early flowering to 80% infested bolls prior to harvest. Marana had equally high infestations at the end of the season, while Maricopa had the lowest infestations ranging from 2% to 5% for Pima and 3%-17% for Upland. Planting date or species of cotton did not affect early infestation. Data comparing plots for overwintering infestations are still being evaluated. Continuous insecticide treatments were made at all locations after squaring began.

INTRODUCTION

Agronomic studies have indicated that Upland cotton can be grown in a short season to help minimize in-season infestations of pink bollworm without reducing yield. This may be accomplished in one of two ways: by either delaying planting date or by early termination (irrigation termination). Delayed planting reduces infestations by promoting suicidal emergence in the spring (i.e., pink bollworms emerge before host food is mature enough to sustain larval growth). If presquaring cotton is present (resulting from delayed plantings) as the overwintering generation emerges, female adults oviposit on cotton plants that will not support larvae (at least 10 day old squares must be present for larval survival) (Graham 1980, Werner, et al, 1979). Watson (1985 and Watson, et al, 1978) found that by terminating, harvesting and destroying crop residue early (to remove host food prior to diapause in the fall), the overwintering population is reduced to a minimal level. Overall in-season populations should be reduced as a result, if done on a communitywide basis. Several studies have indicated that Pima cottons are more susceptible or sustain higher populations of pink bollworm (Fry, et al, 1978; George and Wilson 1983; and Young, et al, 1980) and support a higher density of larvae. Since Pima requires a longer season to mature, and the acreage of Pima cotton is increasing in Arizona, the potential of growing Pima in a short season needs to be investigated.

The purpose of this study is to examine the seasonal insect trends in various early and late plantings/terminations of Upland and Pima cottons at three locations in Arizona: Yuma, Maricopa and Marana. The feasibility of using these practices may depend upon the location and the number of growing days, interactions of these practices on other pests (disease, whiteflies), additional savings from pest control and irrigation costs, as well as effects on yield and quality of the lint. Agronomic variables and yields of this study are reported in this bulletin by Silvertooth, et al, (1990).

METHODS

Three field experiments were initiated in the spring of 1989 on University of Arizona Agricultural Centers (Yuma Valley, Maricopa, and Marana) to evaluate the effects of planting date and irrigation termination date on pink bollworm infestations in both DeltaPine 90 (Upland) and Pima S-6 (Pima) cotton. For each location,

two dates of planting and two dates of irrigation termination were used. Other specifics of the test design can be found in Silvertooth, et al, (1990). See Table 1, (Silvertooth, et al, 1990) for planting and irrigation termination dates for each location.

Procedures for determining insect infestation levels were accomplished as follows. Early season infestations were monitored by counting percent rosetted blooms (i.e., percent of squares with larvae prior to flower opening). This was done on one to two dates prior to green bolls being available. After susceptible-sized bolls were available, weekly counts of infested bolls per plot were monitored (20 bolls per plot). Daily degree day units were tracked through the use of AZMET (Arizona meteorological network) and potential peaks of the overwintering (parent population), F1 through F5 generation adult flights were calculated based on pink bollworm prediction models. Pheromone trap counts (oil-based traps) were used to monitor the adult populations. Traps were counted from 1 to 3 times per week depending upon density of adults and location. Traps were located adjacent to the fields until canopy closure and then traps were moved into the field. Fields were treated with insecticides for pink bollworm (?5-10% infestation rate), *Heliothis* etc. on an as needed basis.

RESULTS

Yuma

Early square and flower infestations were quite low (<0.5% for any treatment) with no effect by a planting date or cotton type ($P > 0.05$). Peak emergence period was predicted in late May with peaks of the F1-F5 predicted to occur about 28-30 days apart beginning in early June (Fig. 1). The F5 generation peak occurs as larvae begin going into diapause (early September). Trap counts do not indicate a clear fit with the predicted peaks due possibly to weather (heavy rains), multiple generation overlap, microclimate efforts, trap inefficiency, and/or model inaccuracy. Analysis of variance of boll infestation rates indicated that the repeated measures (dates) were significantly different. Therefore, main effects of planting dates, and cultivar (species) effects were analyzed for each date, until plots with early irrigation terminated plots received their final irrigation. The sites at Yuma received two substantial rains in late July and early August (timed after early irrigation termination, see Fig.1). These may have complicated and/or nullified the effects of irrigation termination (22.4 and 45.4 mm of rain, respectively). No significant planting date or cultivar effects were measured for any date and interactions of planting and cultivar were significant on most dates. Therefore, analyses separated out cultivar and planting date effects (Fig. 2). Upland infestations were significantly higher in mid-July, but trends reversed in mid-August and then again in early September. Slight termination effects were observed with Upland cotton on the last sample date, while the late planted, late terminated Pima had higher infestation rates. Insecticidal sprays began in early June and were applied approximately weekly until late September (Pounce and/or Cymbush).

Final counts for overwintering larvae were sampled on 30 September. The number of squares and bolls remaining per m row and percent squares and bolls infested with overwintering larvae were measured. More squares per m were found in Pima but number of bolls per m were not significantly different. Fewer squares were infested in Pima cotton ($P < 0.05$) (2-6% in Pima vs. 8-16% in Upland). Boll counts for diapausing larvae are continuing at this point.

Marana

Degree day input was similar for both Marana and Maricopa. Peak parent, F1-F5 generation peaks are represented on the same graph with adult trap counts (Fig. 3). The peak of the overwintering generation (parent) is 3 May with peaks of the next generations about one month apart.

Marana infestations (both flower and boll infestations) were low until the mid-September and then later October-November when most larvae are in diapause. Planting dates were later at this location (14 April and 4 May). No differences in planting dates, cultivars or irrigation terminations were indicated in any analyses for boll infestations prior to harvest. At harvest, square counts (no. per m row) were slightly higher in Pima (12 vs 3.5 per m), while boll counts were slightly higher in Upland cotton (7.5 vs 4.5 per m in Pima). Pima had the highest percent infested squares (38% vs 7.5% for Upland $P < 0.05$). No trends in planting or irrigation termination were noted.

Insecticidal sprays were applied approximately weekly beginning 29 July until late September. Payoff, Asana and Scout were the insecticides used.

Maricopa

Infestation levels were lowest at the Maricopa site on both Upland and Pima cotton (0-17%). Pima was only planted early. No clear differences were observed between planting dates or irrigation termination dates from in-season infestations. Highest infestation levels were observed in mid-October, but these were much lower than at the other sites (3-17% at Maricopa). No trends were indicated with planting or termination in either cultivar. Weekly pesticide applications were made from mid-July through September.

Overwintering fruiting structures were collected on 19 October. Late terminations had higher boll and square counts (no. per m row) than early terminations regardless of the cultivar. Pima had higher square and boll counts than did Upland. However, squares were more heavily infested in late terminated Upland than in late terminated Pima ($P < 0.05$) (Fig. 4).

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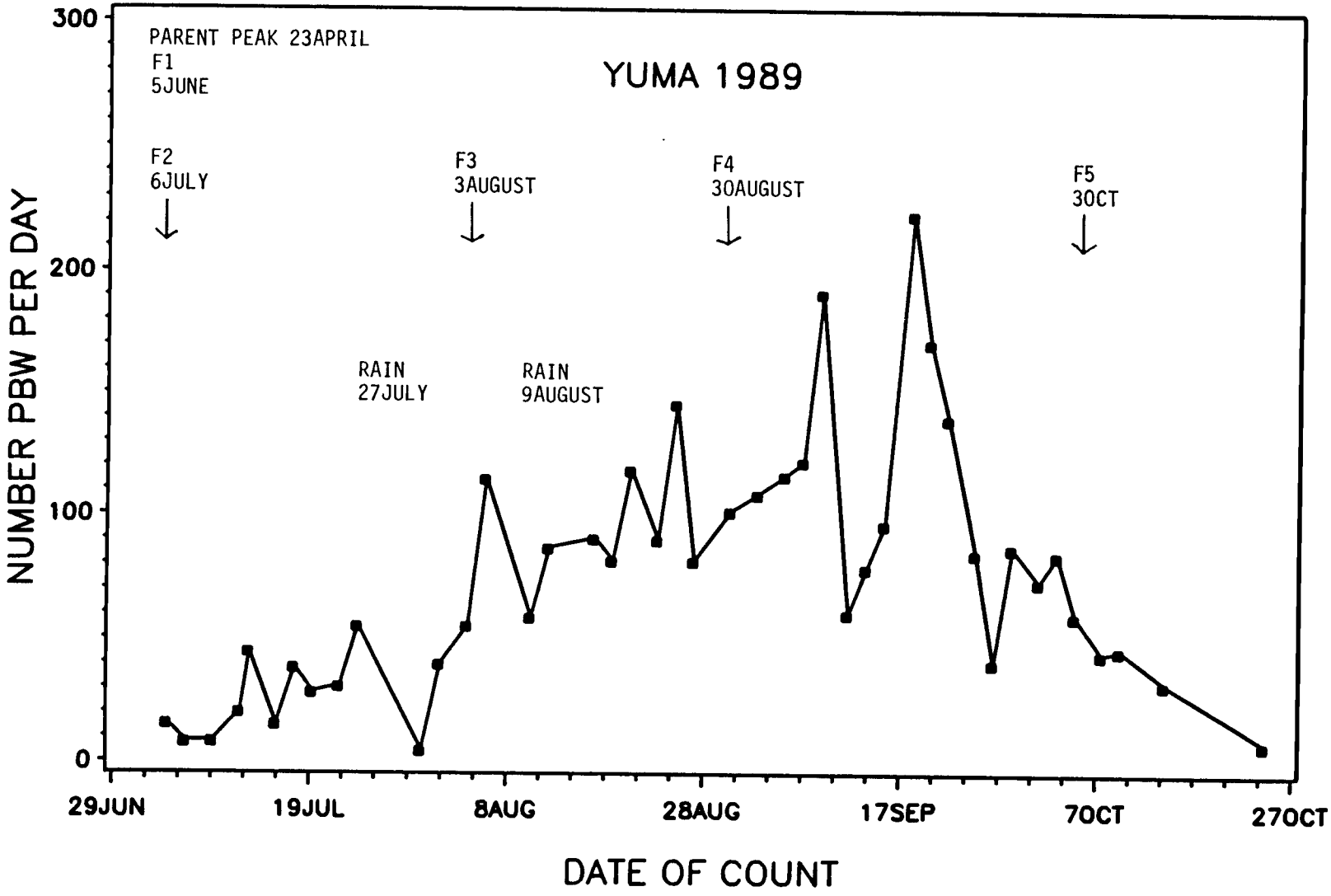
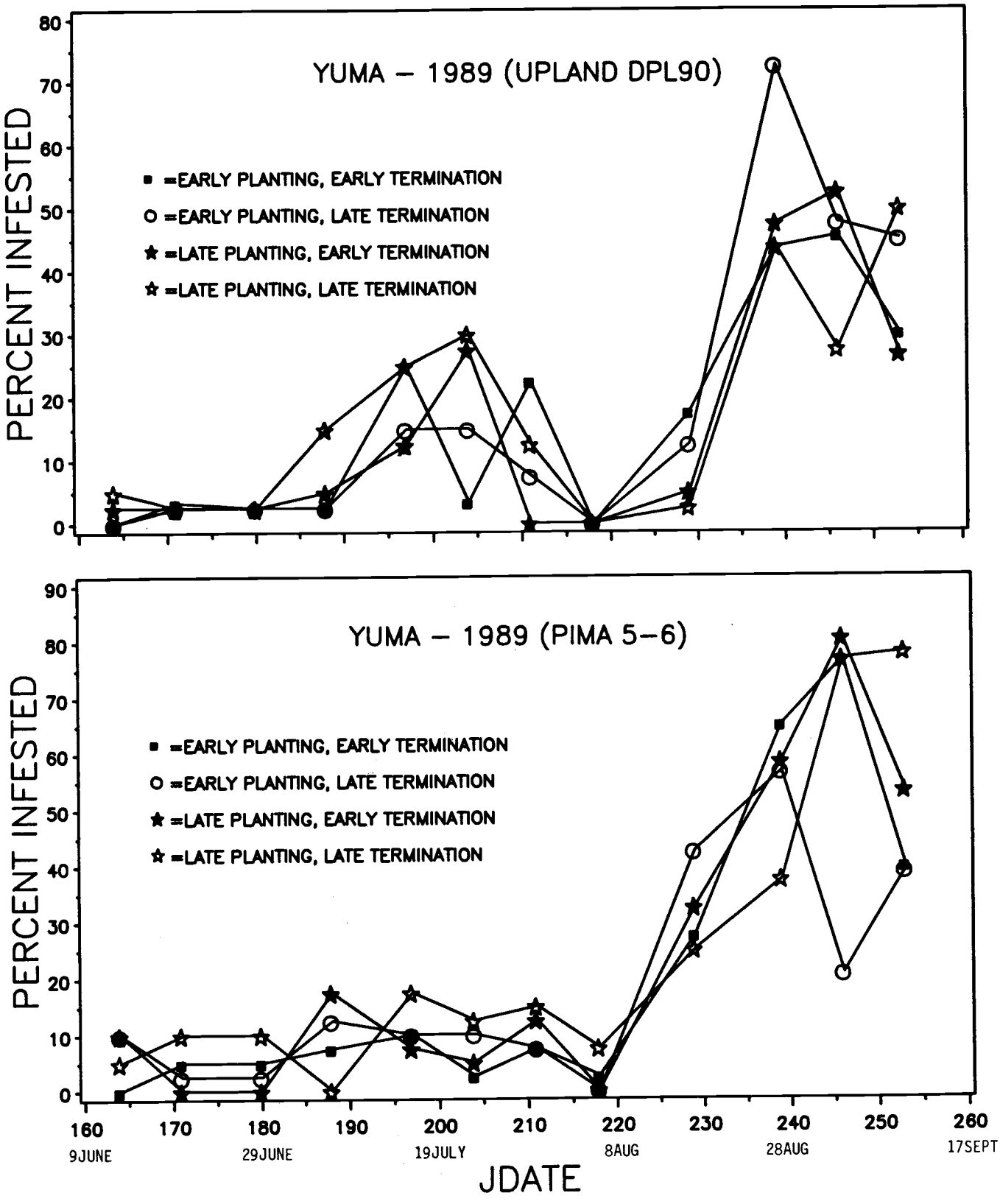


Fig. 1 Adult pink bollworm pheromone trap counts and predicted peak parent and F_1 through F_5 generations by heat units.

Fig. 2 Cotton boll infestation by pink bollworm in Upland and Pima varieties under two different planting date and irrigation treatments.



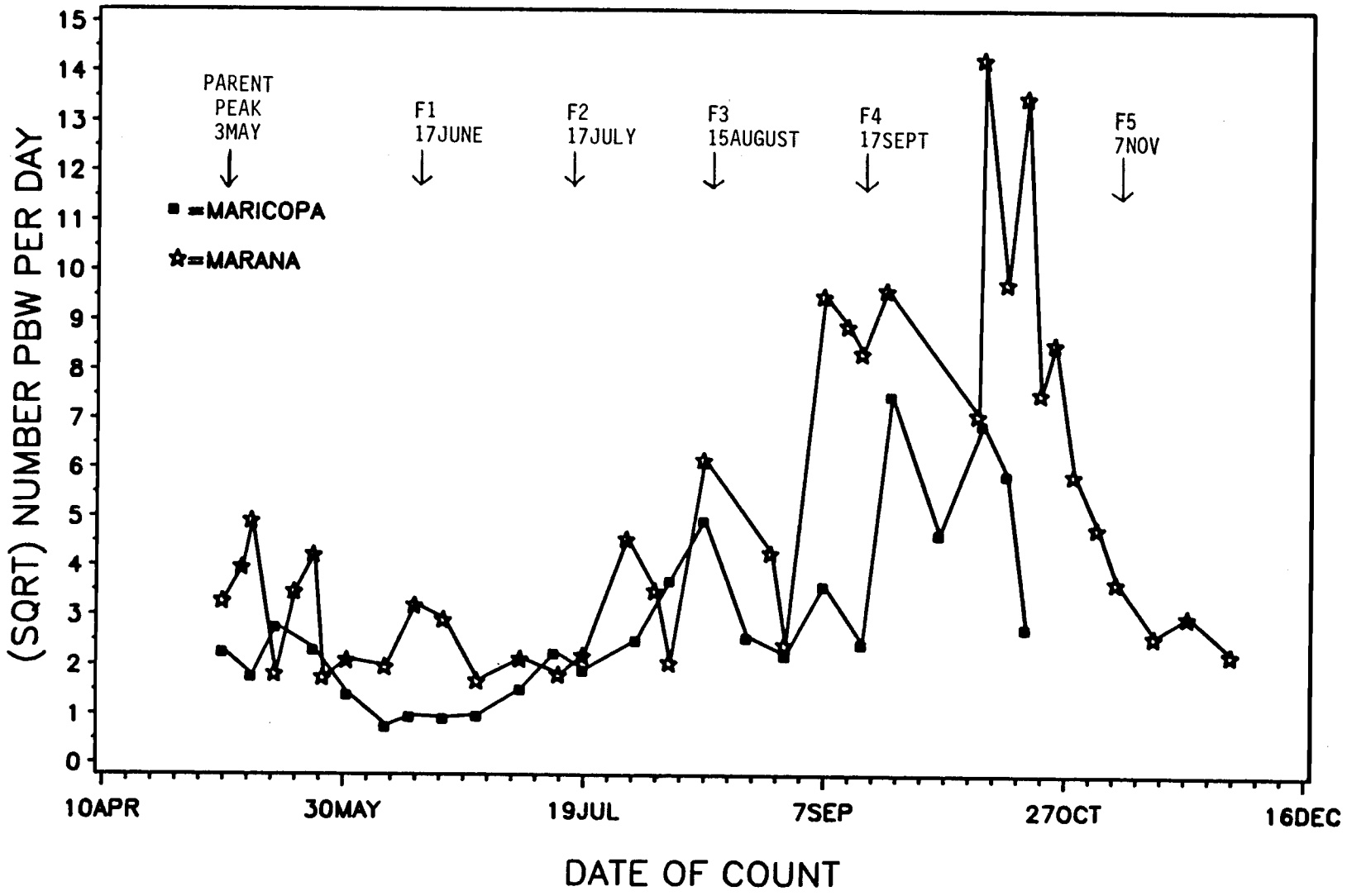


Fig. 3 Adult pink bollworm pheromone trap counts and predicted peak parent and F_1 through F_5 generations by heat units.

Fig. 4 End of season square counts per meter and square infestation by pink bollworm taken on Oct. 19, 1989.
EE: Early planting and early irrigation termination treatment
EL: Early plantig and late irrigation termination treatment
LE: Late planting and early irrigation termination treatment
LL: Late planting and late irrigation termination treatment