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DETERMINATION OF ECONOMIC THRESHOLD FOR MAIZE BORER, *CHILO PARTELLUS* (SWINHOE) AND MAIZE JASSID- *ZYGINA* SP. ON SPRING MAIZE

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In an experiment carried out on spring maize crop, a linear multiple correlation between pest infestation (per cent maize borer infestation and per plant Jassid population) and loss in cob yield was observed. In another experiment, where maize plants grown under muslin cloth cages, were subjected to artificial infestation of maize borer, the loss in yield varied with the stage of plant development at which infestation occurred; first month of plant development was found to be the most critical for maize borer attack whereas, at silking stage the insect practically did no harm to the crop.

INTRODUCTION

Maize, an important food and fodder crop of Pakistan, suffers heavy losses due to a variety of insect pests, of which maize borer, *Chilo partellus* (Swinhoe), and maize jassid, *Zygina* sp., are by far the most important. Although these injurious insects have been effectively controlled with different insecticides (Latif *et al.* 1960, Akram and Yunus, 1972 and Ahmad *et al.*, 1973), no attempt has been made to establish economic injury levels for these pest species. A few efforts made in this direction in other parts of the world, indicated that the loss in yield due to corn borer attack increased with the increase in normal yield and the stage of plant development was an important factor in yield reduction (Patch *et al.*, 1942). Light infestation of corn leaf aphid reduced corn yield by 10 per cent through decreased size and weight of ears (Everly, 1960). High infestation of sugarcane borer caused a reduction in yield of corn (Floyed *et al.*, 1960), but the height of corn plants and the number and size of ears were not significantly reduced even with high borer population (Chiang and Hodson, 1963). The reduction in maize yield caused by *Ostrinia* (*Pyrausta*) *nubilalus* (Hbs.) was maximum when infestation occured at the late whorl stage, less when it occurred at silking staged, at which it was not significant (Cheo *et al.*, 1964).

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The purpose of the present study was to establish relationship between pest infestation and loss in yield with a view to arriving at economic threshold for maize borer and maize jassid on spring maize crop.

MATERIALS AND METHODS

An experiment was laid out in a completely randomized block design and the infestation levels were maintained by spraying the crop with folidol M. @ 0.5 lb. a.m./acre at weekly, fortnightly and monthly intervals and by keeping a check where no spraying was done.

Observations on jassid population, percentage infestation of maize borer and crop yield were recorded. For jassid population six plants from each plot were randomly selected and number of jassids per plant were counted but when plants became high, three leaves (one each from top, middle and bottom of a plant) were selected and number of jassids per leaf was recorded. Healthy and infested plants from each plot were also observed separately for height, number of cobs per plant, weight of cobs, number of grains per cob and weight of 100 grains, to see the effect of different treatments, if any, on the vigour of the plants.

Experiments were also carried out by liberating a known number of borer larvae and jassid adults on plants caged with muslin cloth in the field and on plants raised in earthen pots and placed in wire-guaze cages, to see the effect of different levels of pest infestation on the performance of such plants.

RESULTS AND DISCUSSION

As a result of these studies, different levels of overall average infestation of maize borer viz., 1.36, 12.20, 18.17 and 19.34 per cent and per plant jassid population of 5.31, 9.11, 12.00 and 12.24 insects were obtained in weekly (T_1), fortnightly, (T_2) and monthly sprayed (T_3), and check (T_4) plots, respectively. The overall average damage grade of leaves due to jassid infestation in the respective treatments was 1.48, 2.36, 3.12 and 3.41 when zero damage grade was kept as normal and grade 10 as complete damage. Keeping T_1 as standard treatmeat i.e. no loss the percentage loss in yield under T_2, T_3 and T_4 was 10.35, 22.40 and 48.26 per cent, respectively (Fig. 1). From these data, the following regression equation was worked out which showed that a linear multiple relationship existed between pest infestation [per cent maize borer infestation (x_1), per plant jassid population (x_2)] and loss in yield (Y).

$$Y = 4.60 + 0.003563\ x_1 + 1.750145\ x_2.$$

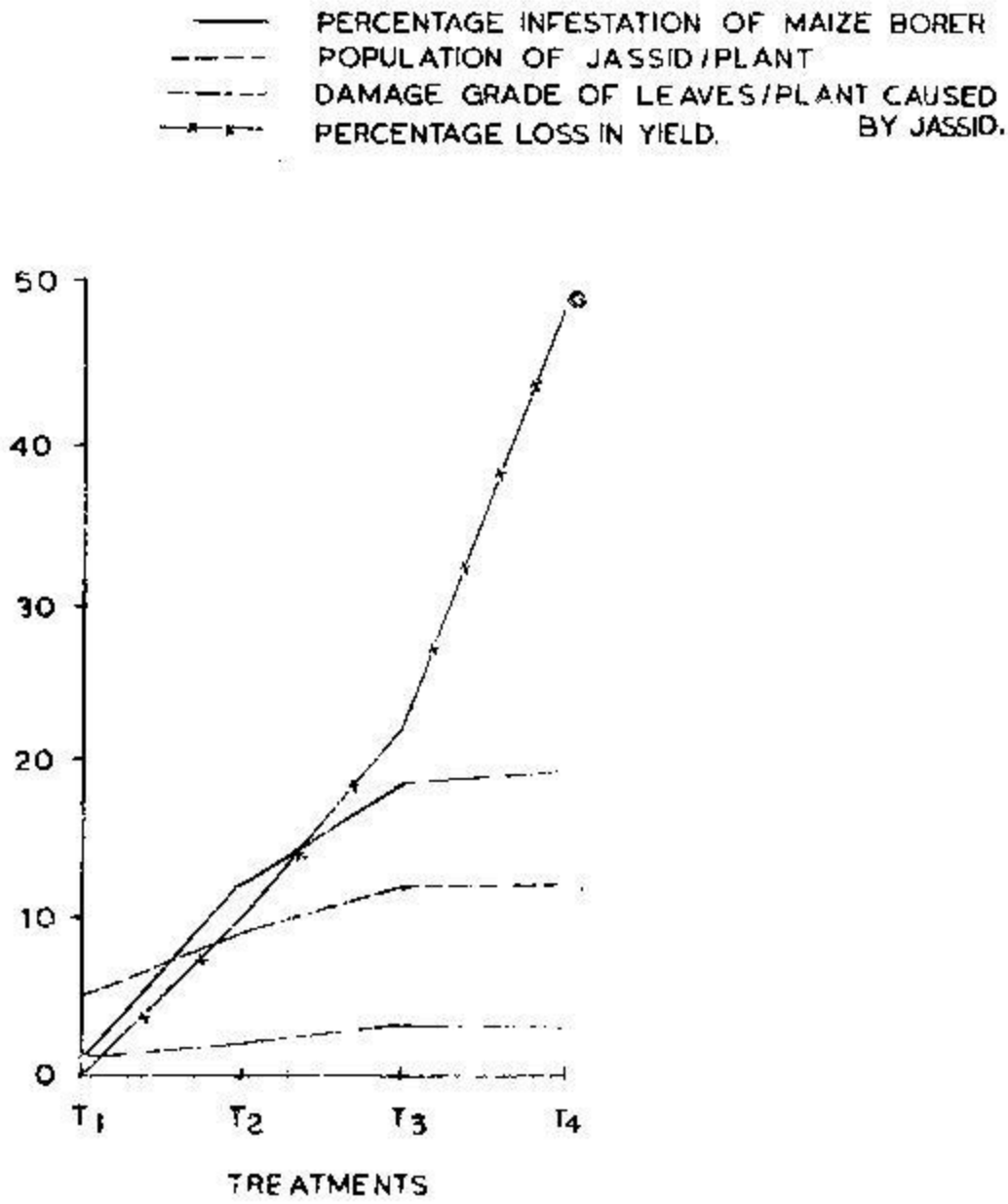


Fig. 1. Pests infestation and loss in yield.

In the present study, it was observed that under the optimum insecticidal control (T_1), 1.36 percent infestation of maize borer and 5.31 jassids per plant were present in the field. In a hypothetical situation, if 6.36 per cent borer infestation and 9 jassids per plant are recorded in a maize field (overall average) the loss in yield could be calculated as under:

$X_1 = 6.36 - 1.36 = 5.00$ per cent borer infestation

$X_2 = 9.00 - 5.31 = 3.69$ jassid per plant

$Y = -4.60 + (0.003563)\ (5) + (1.750145)\ (3.69)$

$= -4.60 + 6.46 = 1.86$ lbs per plot

It can be concluded from the above example that 6.36 per cent infestation of maize borer and 9 jassids per plant caused a loss in yield by 198 lbs or 2.41 maunds per acre due to the above mentioned levels of insect pest infestation. Taking into consideration, the cost of insecticide applied and the economic gain from increased yield, the ratio between cost and return would be 1:3, so it would be worthwhile to control the pest in such a situation.

Six each of healthy and infested plants from each treatment compared to see the effect of different treatments on the intensity of infestation (Figs. 2 & 3) indicated that although there were slight differences in the degree of infestation under different treatments, these differences were not significant. However, when healthy and infested plants, taking all the treatments together were compared it was found that there was significant decrease in the height of plants, number of cobs per plants, weight of the cobs, number of grains per cob and weight of 100 grains due to insect pest infestation over healthy plants.

In artificial infestation experiment, where two 2nd instar maize borer larvae per plant and in one treatment 5 adult jassid per plant were released, the loss in yield varied with the stage of the plant development (Figs. 4 and 5) at which release was made and the first month of plant growth was found to be the most critical period especially for maize borer attack. In case of plants raised in pots and infested artificially at various developmental stages, after placing them in wire gauze cages, the cobs were not borne by the plants but the final plant height varied with the growth stage at which infestation was made (Fig. 6). The height was greater where plants were infested at later stages of growth as compared to those which were infested at earlier stages of plant development. These findings also explain the reason for the low value of X_1 in the regression equation as the attack of maize borer on spring crop occurs when the plants are quite grown up. It also shows that jassid is the key pest of spring maize.

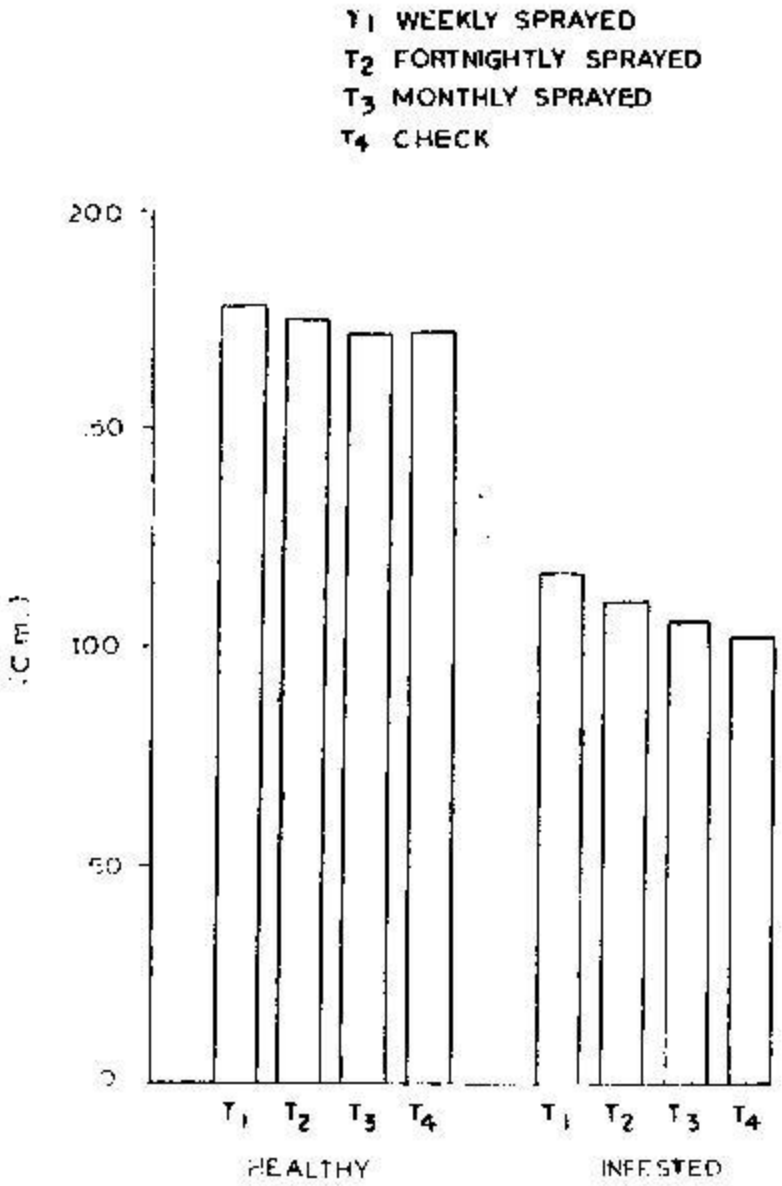
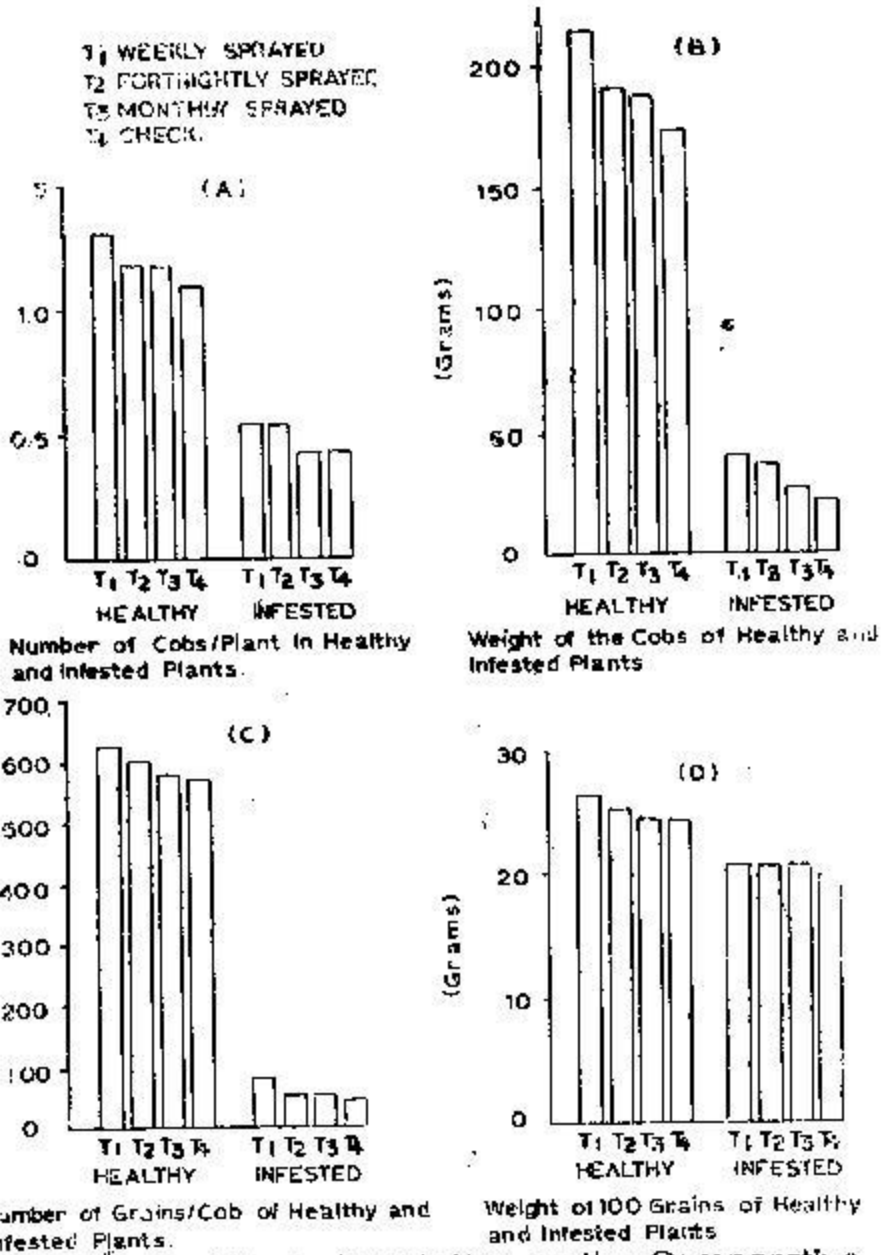


Fig 2 Height of Healthy and Infested Plants
(UNDER DIFFERENT TREATMENTS)



Number of Cobs/Plant in Healthy and Infested Plants.

Weight of the Cobs of Healthy and Infested Plants

Number of Grains/Cob of Healthy and Infested Plants.

Weight of 100 Grains of Healthy and Infested Plants

Fig. 3 Effect of Pests Infestation on the Comparative performance of the Plants.

(UNDER DIFFERENT TREATMENTS)

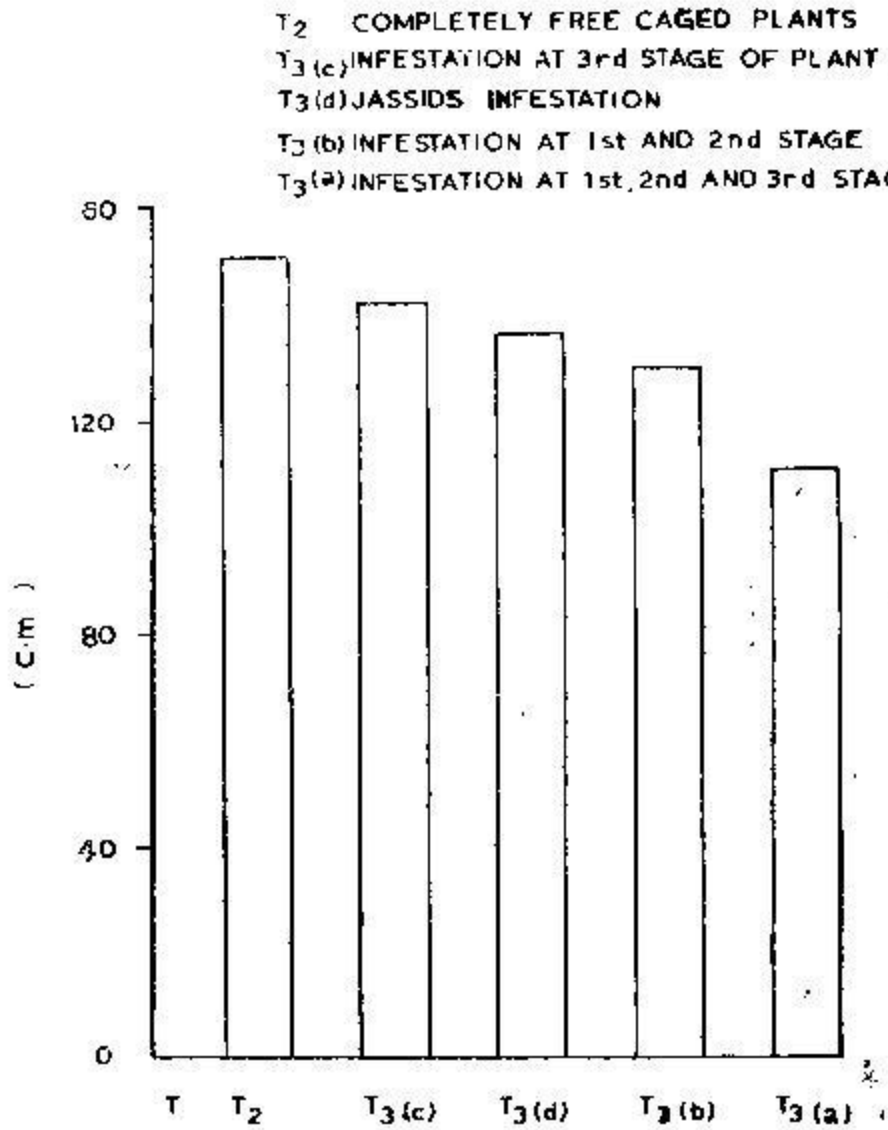
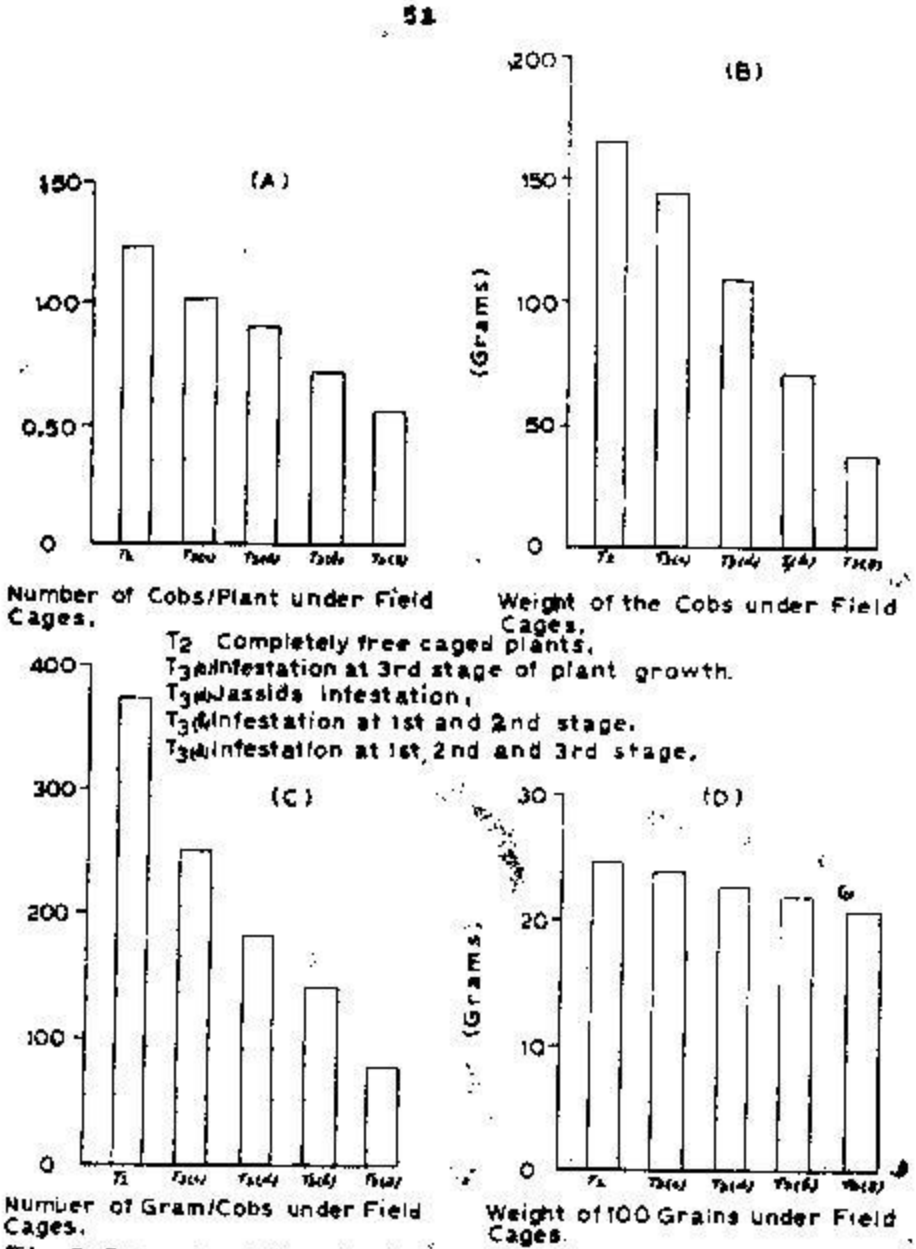


Fig. 4. Final Height of Plants under Field Cages.



Number of Cobs/Plant under Field Cages.

Weight of the Cobs under Field Cages.

T_2 Completely free caged plants.
$T_{3(a)}$ Infestation at 3rd stage of plant growth.
$T_{3(b)}$ Jassids infestation.
$T_{3(c)}$ Infestation at 1st and 2nd stage.
$T_{3(d)}$ Infestation at 1st, 2nd and 3rd stage.

Number of Gram/Cobs under Field Cages.

Weight of 100 Grains under Field Cages.

Fig: 5. Effect of Pests infestation on the Comparative Performance of the Plants under Field Cages

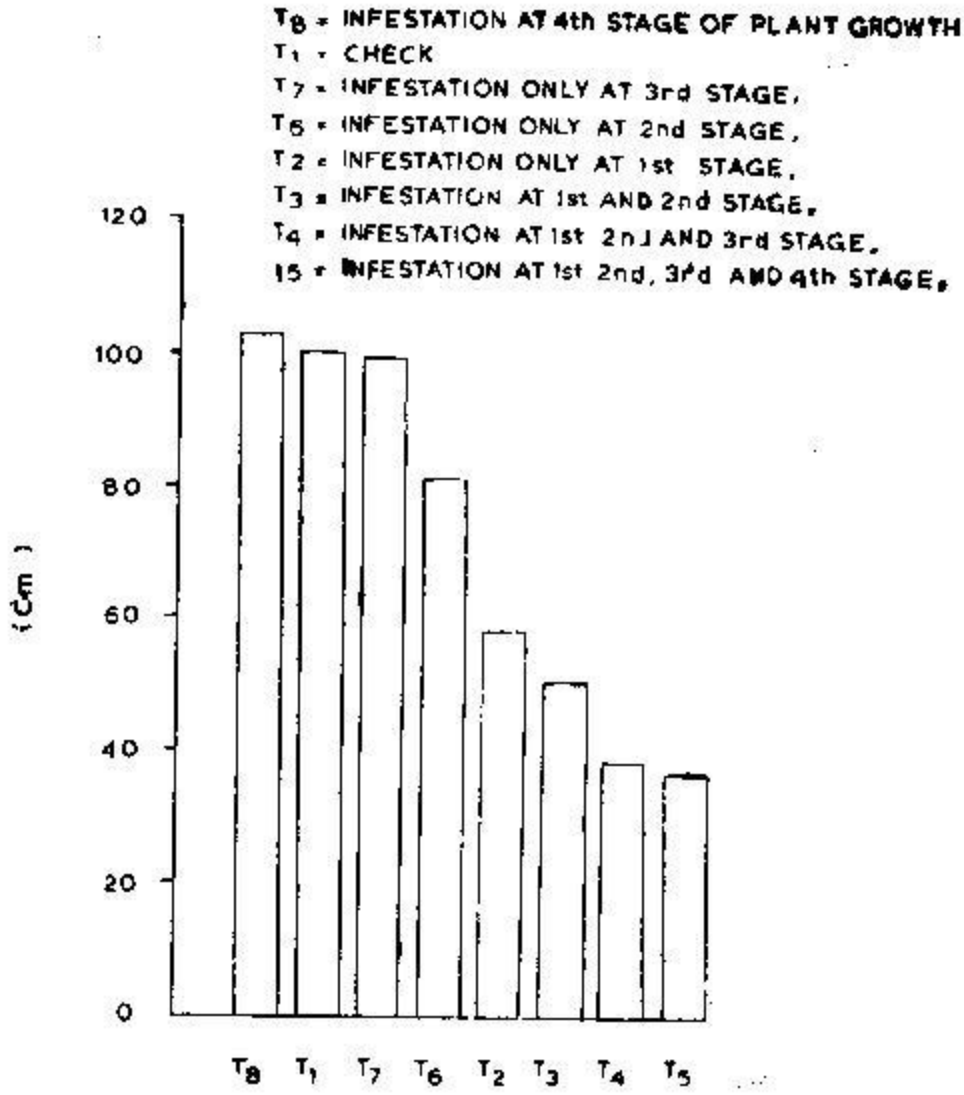


Fig.6 Final Height of the Plants under Laboratory Cages

The results of the present investigations indicated that the loss in crop yield was directly proportional to the density of the pest insects. Pest infestation affected the vigour of the plants and the quantity of the produce. The height of plants and the number and size of ears due to pest infestation also significantly decreased. These findings are in agreement with those of Floyd *et al.* (1960) and Everly (1960) but are at variance with those of Chienge and Hodson (1963). These studies also revealed that loss in crop yield varied with the stage of the plant development at which infestation occured and the intensity of damage was greater in cases where infestation occured at earlier stage of plant growth. Infestation at later stages of plant growth, however, did not cause significant decrease in the crop yield. These findings are in conformity with those of Patch *et al.* (1942) and Cheo *et al.* (1964). Thus the foregoing account has led to the conclusion that first month of plant development is the most critical period for maize borer attack while on the other hand infestation at later stage (i.e. silking stage) proved almost harmless for plant growth and crop yield. It is, therefore, worthwhile to give proper attention to insect pest control in the early stage of crop growth.

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