GROWTH AND YIELD RESPONSE OF MAIZE (*Zea mays*) INTERCROPPED WITH DIFFERENT CROP DENSITIES OF GREEN GRAM (*Vigna radiata*)

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ABSTRACT

The recent statistics showed that the extent under maize cultivation is increased in Jaffna as there is no way to bring maize from other parts of the country. But the maize cultivation is not very profit due to high cost of production. The income per unit area has to be increased to sustain the cultivation of maize in Jaffna. Therefore an experiment was conducted to test the possibilities of introducing green gram as an intercrop with maize planted at recommended spacing (90 cm x 30 cm). A field experiment was conducted during August 2007 to December 2007 to find the growth and yield response of maize intercropped with green gram at the Agricultural Research Station, Thirunelvely, Jaffna, Sri Lanka. The population of the maize crop was maintained as same at recommended spacing and three different spacing of green gram were tested. The experiment was carried in randomized complete block design with four replicates. Maize was planted in rows at 90cm X 30cm and green gram was planted as intercrop in between maize rows in the spacing of 30cm x 10cm (T_1), 22.5cm x 10 cm (T_2) and 18cm x 10cm (T_3). Green gram was seeded 15 days after seeding maize. The yield and growth parameters such as height, leaf area, pod number, etc. of maize and green gram were recorded. The yield parameters and growth parameters of maize among the treatments are non-significant. Therefore yield of maize was not significantly affected by intercropping with green gram. But the yield components of green gram were differed significantly. The three rows of green gram between maize rows (T_2 treatment) gave higher yield than other treatments. The highest land equivalent ratio (LER) 1.20 was also recorded in the same treatment (T_2). The farmer in Jaffna district can be advised to intercrop three rows of green gram at the spacing of 22.5cm x 10cm in between maize to maize rows which is planted at recommended spacing of 90 cm x 30 cm to increase the profit from unit land area.

Key words: Growth parameters, Intercrop, Land Equivalent Ratio (LER), Main crop, Yield Parameters

INTRODUCTION

Intercropping is defined as the growing two or more crops simultaneously on the same field. The main advantages of intercropping are greater stability of yield over different season, better use of growth resources, sharing physical support, shade and shelter between the crop, better control of soil erosion and safeguard to the small farmer when one crop may fail (Chatterjee *et al,* 1989).

The extent under maize cultivation in Jaffna is increased due the closuere of the A(road. Jaffna farmers grow maize as sole crop. Intercropping green gram with maize is a common practice in several tropical countries. But due to lack of knowledge on intercropping especially in the proper spacing combinations farmer do not like to practice intercropping Considering these facts a study was carried out at the Agricultural Research Station, Thirunelvely with the objectives to study the effect of spatial arrangement of green gram as a intercrop in maize , to study of judicious utilization of resources such as land, labour and inputs in an intercropping maize with green gram, to study about effect of light reception and shading on yield and weed control and to find the best spacing for green gram t intercrop with maize.

MATERIALS AND METHODS

An experiment carried out in Randomized Complete Block Design (RCBD) with four replicates. Maize was planted at recommended spacing of 90cmx30cm in the all plots. Then green gram was planted in three different spacing as

T_1 treatment - 30cmx10cm,
T_2 treatment - 22.5cmx10cm
T_3 treatment - 18cmx10cm.

The sole crops of green gram and maize were planted at recommended spacing around the experimental plots to get the average sole crop yields. The Land Equivalent Ration (LER) was calculated as ratio between intercrop yield and sole crop yield. In order to make the LER to be distributed normally and to perform parametric statistics the sole crop yield must be obtained from larger area. Because of this the sole crop treatments were not included as control and planted in larger area around the experimental plot. Agronomic practices were done as recommended by Department of Agriculture. Growth parameters were recorded at regular intervals and at harvest yield were recorded and Land Equivalent and means were compared using Duncan Mean separation procedure.

RESULTS AND DISCUSSION

Height of maize

The green gram was planted in the field 15 days after maize seeding. Therefore the height of maize was analyzed from 4th week as the effect of green gram on height of maize will start after introducing green gram and the maize planted achieved it maximum height at 6th week and started to flower thereafter. Therefore the height of maize plants between 4th to 6th was taken for the discussion.

The difference of Maize plant height between treatments 4th, 5th and 6th week after planting were not statistically significant. Any how the average plant height of maize in the sole crop treatment is slightly higher than that of intercropped maize plant height. In all treatment plots maize plant population was kept constant, but the green gram plant population was increased. Therefore competition for nutrients and other factors may be increased and that may be the reason for the low average plant height of maize in intercropped treatments (Chhiddasingh, 1996)

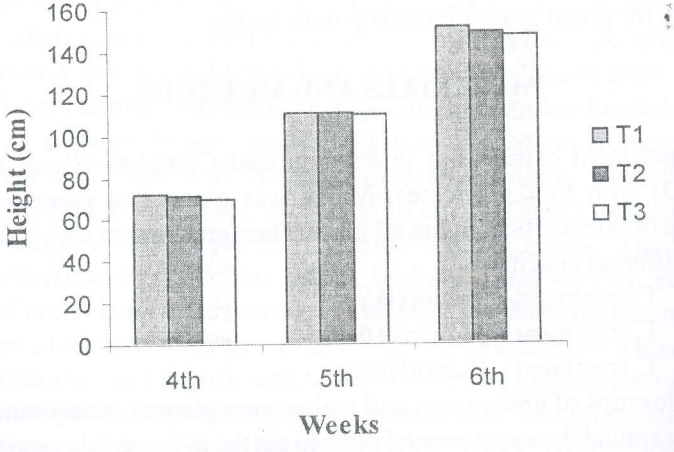


Figure 1: Plant height of maize in different growth stages

Height of green gram

The difference of green gram plant height between treatments 3rd, 4th and 5th week after planting were not statistically significant. Higher plant height was shown in between 4th and 5th week after planting. It may be due to the shading effect caused by already established maize canopy

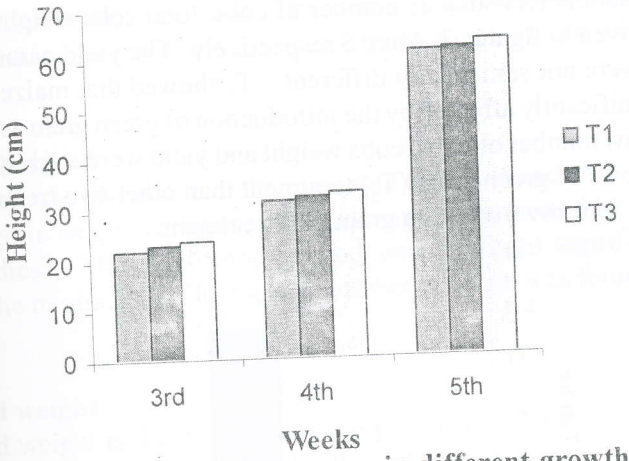


Figure 2: Plant height of green gram in different growth stages

Yield parameters

Yield parameters of maize

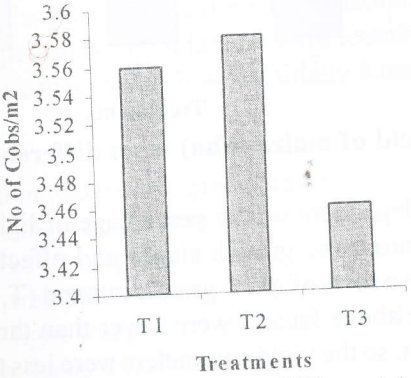


Figure 3: Number of cobs in different treatments

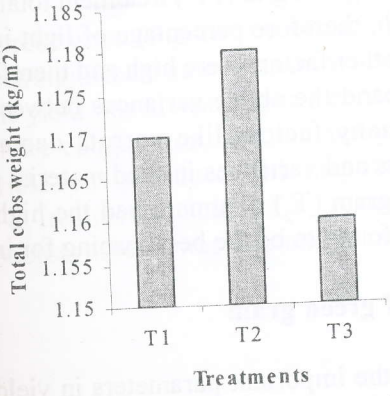


Figure 4: Cob weight of maize (kg/m^2) in different treatments

Yield parameters such as number of cobs, total cobs weight and yield were given in figures 3, 4 and 5 respectively. The yield parameters and yield were not statistically different. T_1 showed that maize yield was not significantly affected by the introduction of green gram as intercrop. Any how number of cobs, cobs weight and yield were slightly higher in three rows of green gram (T_2) treatment than other two treatments and least in four rows of green gram (T_3) treatment.

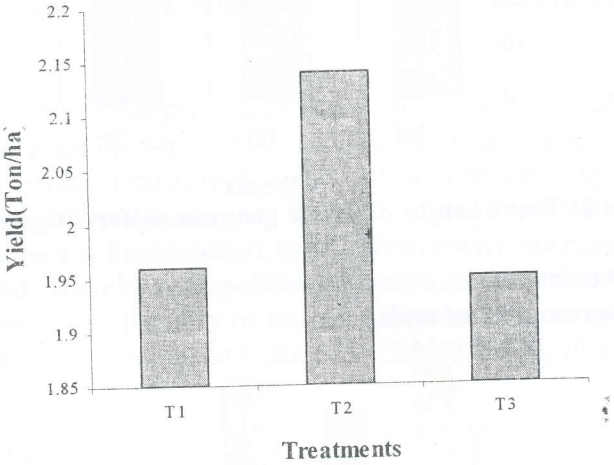


Figure 5: Yield of maize (t/ha) from different treatments

Yield is strongly dependent on the percentage of light interception by the leaf canopy during the growth stages and effective utilization of resources. But in two rows of green gram treatment (T_1) plant population was low, therefore above factors were lower than three rows of green gram (T_2) treatment, so the yield parameters were less than T_2 treatment.

In case of four rows of green gram (T_3) treatment total plant population were very much high, therefore percentage of light interception high but the competition other factors were high and therefore the yield was low. On the other hand the above variances between the treatments may be cause by many factors like parrots damage, get various environmental factors and variances in seed material etc. Anyhow the three rows of green gram (T_2) treatment had the high and utility and other characters and found to be the best spacing for intercropping.

Yield parameters of green gram

Pod length

Pod length is one of the important parameters in yield. Pod length of green gram in each three treatments was not significant. The highest

pod length was 9.35cm recorded in two rows (T_1) treatment. This may be due to the less competition for necessary factors between plants in T_1 treatment.

Seed number/pod

Seed number per pod is one of the important yield parameter. It affects the 1000 grain weight and the yield. It is mainly determined by rate of photosynthesis. The seed number /pod were differed significantly between the treatments. The highest number of seeds was found in T_2 treatment.

1000 seed weight

1000 seed weight is the major yield component which determines the total yield of green gram. The 1000 seed weight was statistically significant among treatments. Three rows of green gram (T_2) treatment in between two maize row gave the highest 1000 seed weight (47.34g) and the least 1000 grain(42.54g) was recorded in four rows of green gram treatment. In the four rows treatment population of plant was high and therefore competitions for all factors were found very high. Due to that photosynthesis capacity was low and finally it resulted in low 1000 grains weight.

1000 grains weight in two rows of green gram (T_1) treatment 1000 grains weight was lesser than three rows of green gram (T_2) treatment, but greater than four rows of green gram (T_3) treatment. In two rows of green gram (T_1) treatment plant population was very less, no any competition, but light trapped by plant by the plants was less, and therefore photosynthesis were less.

Yield

The yield of the green gram (Figure 6) was statistically significant and each treatment was significant among them. When the plant population was increased, the yield was increase up to a particular level. Above the optimum level more competition, shading and pest and disease were developed and yield start to reduce. This may the reason for the yield reduction in the T_3 treatment. In case of T_1 treatment light capture was less, therefore photosynthesis was less and it cause low yield than T_2 treatment.

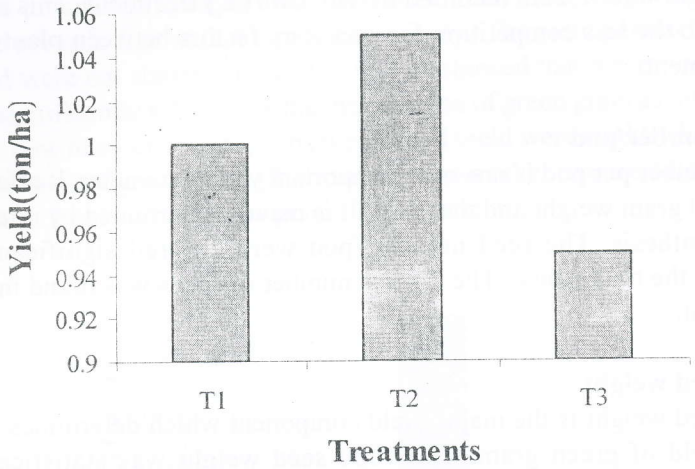
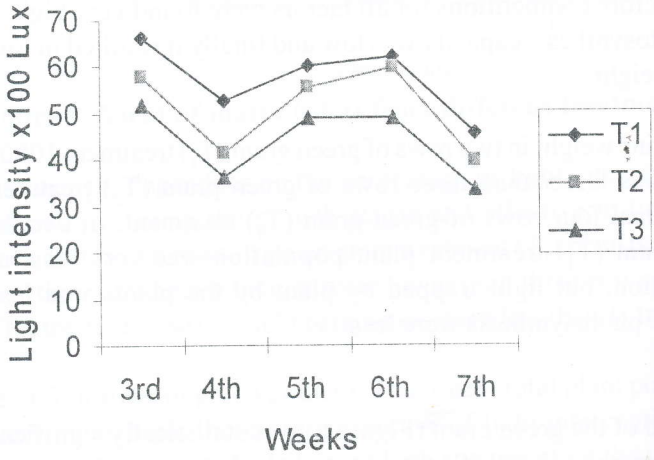


Figure 6: Yield of green gram (t/ha) in different treatments

Light Intensity and yield



The measurement of light intensity was measured at the ground level Yield is proportionally increasing with the light interception by the lea canopy during the growth stages. The high light interception wa recorded in the plot with high plant population (three rows of gree gram -T_3 treatment). Any how the yield is lower in this treatment is ma be may be due to the competition for other factors like water, nutrien etc. The highest yield was recorded in the two rows of green gra intercropped within two rows of maize planted at recommended leve (T_2).

Land equivalent ratio (LER)

The results reveals that the high LER of 1.12 was recorded in T_2 treatment, where three rows of green gram between two rows of maize .It is indicated that 12 % yield advantage is obtained when compare to growing as sole crop. In other words, the sole crops have to be grown in 1.12 ha to get the same yield level that is obtained from one hectare of intercropping. Therefore based on the LER value the T_2 treatment, where three rows of green gram between maize rows system of intercropping is found to be efficient in terms of yield benefit.

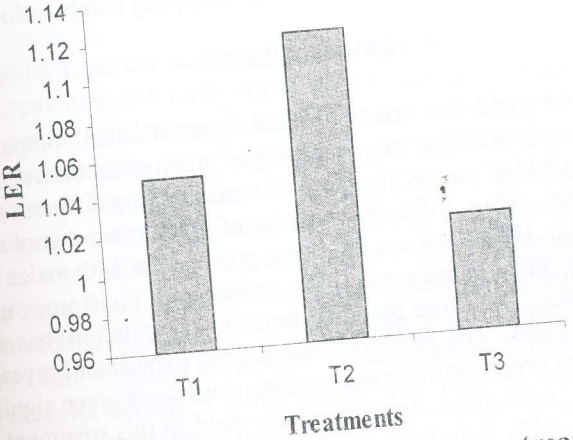


Figure 7: Land Equivalent ratio among treatments

Gross income

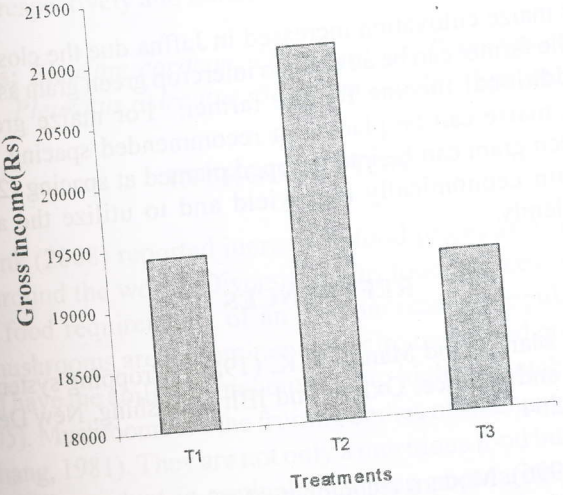


Figure 8: Gross income in different treatments

Gross income in different intercropping system was calculated on the basis of yield per hectare. . The figure 8 shows, the highest gross income per ha was obtained in three rows of green gram treatment (T_2). Higher LER and yields were also recorded in the same treatment. From this finding it is obvious that the farmer who cultivate maize and green gram as intercrop he can increase his production and income .It was also found that the yield difference of maize is not significant in all treatments. Hence the green gram yield in this intercropping system is a bonus yield and additional income. In the T_2 treatment maize and green gram yield were obtained high and gave the highest gross income. Therefore three rows of green gram between maize rows is the best intercropping combination.

CONCLUSION

The maize crop yield was not significant reduced when compare to sole crop yield. It's showed that intercropping of green gram between maize is not affect the yield of maize.The yield of maize among different treatment is not significant. Thus, different densities of green gram do not affect the main crop yield. Hence we can intercrop green gram with maize with out reducing maize yield significantly. The green gram yield was significant among treatment. Therefore planting densities (population) has an effect on green gram yield. The results obtained from experiment revealed that the three rows of green gram between maize rows were given significantly higher yield in green gram. Average maize yield in this treatment is high anyhow it not significantly high when compare to the yield of maize from other treatments. The highest LER was also recorded in T_2 treatment where green gram was planted in three rows between maize rows.

The extent of maize cultivation increased in Jaffna due the closure of the A9 road and the farmer can be advised to intercrop green gram as intercrop will be an additional income for the farmer. For maize green gram intercropping, maize can be planted at recommended spacing (90cm X 30cm) and green gram can be intercropped planted at spacing (22.5cm X 10cm) to obtain economically high yield and to utilize the available resources efficiently.

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