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Effect of Maize Population (As Intercrop) on the Growth of Ratoon Sugarcane and Maize Yield

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Abstract: The study was conducted on the effect of maize population on the growth of ratoon sugarcane and maize yield Data was recorded on different yield and yield components of maize.. Maximum (164.4 cm) and minimum (133.6 cm) plant height of maize was attained with 30,000 plants ha^{-1}. Maximum number of (10.73 leaves $plant^{-1}$), cob length (19.2 cm) and grains cob^{-1} (205.2) were recorded with 30,000 maize population ha^{-1}. While maximum barrenness of 18.90 was observed in plots containing maximum maize population of 60,000 plants ha^{-1}. Maximum grain weight (240 g), grain yield (2400 kg ha^{-1}) and harvest index (15.45) were recorded with lowest maize population of 30,000 plants ha^{-1}, while maximum (7.2) and minimum (4.5 kg) biological yield unit $area^{-1}$ were recorded in 30,000 and 60,000 plant population of maize ha^{-1} respectively, maximum number of shoots $stump^{-1}$ were 8.91, 11.33 and 12.08 with 30,000 plant population of maize ha^{-1}, while minimum 0.57 were observed in 30,000 maize population ha^{-1} respectively. Maximum of 68.88 and minimum of 59.02 cm sugarcane heights at maize harvest were recorded with 30,000 and 60,000 maize population ha^{-1} respectively.

Key words: Maize, intercrop, ratoon sugarcane

Introduction

There are a number of ways for increasing yield but intercropping is comparatively a new concept and is gaining ground owing to scarcity of arable land. Planting density could be a major limitation and needs further study. Too low a population of maize may be wastage of time and money. Too thick population of maize may overshadow the main crop i.e. sugarcane and may be a source of insect pest harboring which may be detrimental to both the crops. The human population of Pakistan is increasing day by day at the rate of almost 3 % per year and increased number of mouths to be fed with balanced and desirable diet for well built Pakistan nation. In the spring season the growth of sugarcane almost remains stunted up to 3-4 months and this situation could be taken advantage of by planting maize in between two rows of sugarcane beneficially. By this way the sugarcane crop will also be benefited through fertilization and irrigation and weeds infestation could also be minimized with the process of smothering sugarcane crop.

Govinden and Arnason (1990), who observed that the maize competed with the cane for light and that intercropping reduced cane yield. Maize canopy developed rapidly and despite having lower stomata conductance than the sugarcane at beginning of the season, it intercepted much more of the light and transpired most of the water used by mixed crop (Batchelor *et al*., 1990). Jayabal and Sankaran (1991), who reported that more nutrients (N), non-dense intercrop and moisture available to plants increase growth rate. Hera *et al*. (1991), who reported that more nutrients increase the reproductive growth i.e., seed yield. Kanwar *et al*. (1993) reported that initially there was no intercropping and hence no competition while 30 days after maize seeding nutrients and moisture were shared by both the crops and difference in the number of shoots $stump^{-1}$ was visible. Saini and Singh (1994), concluded that from a field experiment that the sugarcane and maize intercrop, showed good results when proper amount of nutrients were available.

Keeping in view the above situation it was desirable to design an experiment to determine optimum maize population for intercropping in ratoon sugarcane for boosting maize and sugarcane yield and meeting the national requirements.

Materials and Methods

An experiment entitled effect of maize population on the growth of ratoon sugarcane and maize yield was conducted in Malakandher Research Farms of NWFP Agricultural University, Peshawar during 1998-99. Basal dose of 120-90 N-P kg ha^{-1} was applied to the experimental field, half of the form of urea was applied at sowing while the remaining half of N was applied at the second irrigation. All cultural practices were uniformly carried out throughout the growth period.

In each sub plot 9 plants of maize with maximum, optimum and minimum heights were randomly selected and no. of leaves plant^{-1} along with their heights was measured (cm). The maize crop was thinned out to the requisite plants m^{-1}.row i.e. 3, 4, 5 and 6 plants m^{-1} row to have the required population in the respective plots according to the desired plan. After harvest of maize crop 9 cobs were randomly selected from the different plant populations and their lengths were recorded. The number of grains of all the 9 cobs was counted and averages were worked out. Out of one hundred plants treatment^{-1}, the non-ear-bearing plants were counted as barren plants. The 9 cobs were threshed separately, their grains were mixed thoroughly and 1000 grain were counted and weighed. The central 3 lines of each treatment were harvested for yield purpose. The stalks were allowed to dry in the open air, cobs were sun dried and threshed. The cleaned grains of each treatment were weighed and recorded. From each sub plot having different plant populations, material harvested and weighed for biological yield. Harvest index (H I) was found with the help of following formula,

$$H\,I = \frac{\text{Economic yield}}{\text{Biological yield}} \times 100$$

For the observations recorded on sugarcane crop following procedure were adopted. As sugarcane stumps were already present in the field so just before the sowing of maize, the number of shoots stump^{-1} of sugarcane crop were counted. For this purpose the stumps were marked by pitching pegs or wooden stakes with white paper on their tips for observations. The above-mentioned procedure was adopted to have the data on number of shoots stump^{-1} at month's interval i.e. April, May and June 1999. At the harvest of maize crop, the sugarcane plants having maximum, optimum and minimum heights were recorded along with the No. of water shoots present with these plants (September, 1999)

Data regarding growth and yield parameters of maize cultivars were recorded and analysed statistically (Steel and Torrie, 1980).

Results

Statistical analysis of the data (Table 1) indicated that maximum plant height of 164.4 cm and maximum number of leaves plant^{-1} of 10.73 were recorded with lowest plant population of 30,000 plants ha^{-1}. While minimum plant height of 133.6 and minimum number of leaves plant $^{-1}$ of 8.37 were recorded with highest plant population of 60,000 plants ha^{-1}. It may be due to lowest plant population, more water, nutrients and solar radiation were available to the plants, so the vegetative growth of plants was enhanced and while due to higher population vegetative growth was adversely affected so minimum number of leaves plant^{-1} were noticed. These findings are confirmed by Jayabal and Sankaran (1991), who reported that more nutrients, non-dense intercrop and moisture available to plants increase growth rate.

Maximum cob length (19.2 cm) was attained by lowest maize plant population of 30,000 plants ha^{-1} while minimum cob length (16.2 cm) was recorded in highest plant population of 60,000 plants ha^{-1}. Maximum of 18.90 % barrenness was noticed with highest plant population of 60,000 plants ha^{-1}, while lowest of 9.35 % was seen in lowest plant population of 30,000 plants ha^{-1}. Maximum (205.2) and minimum (141.8) grains cob^{-1} were recorded with 30,000 and 60,000 plants ha^{-1} respectively (Table 1). It may be to low plant population, more nutrients and sunlight were available and so reproductive growth of the plant was enhanced. These findings are confirmed by Hera *et al.* (1991), who reported that more nutrients increase the reproductive growth i.e. seed yield.

Analysis of the data (Table 1) revealed that highest grain weight (240.0 g) and grain yield (2400 kg ha^{-1}) were observed in 30,000 plants ha^{-1}, while lowest grain weight of 122.5 g and grain yield of 1225 kg ha^{-1} were recorded in plant population of 60,000 plants ha^{-1}.

Highest harvest index (15.45) and lowest (7.41) were seen in 30,000 and 60,000 plants ha^{-1} respectively while highest biological yield of 7.25 kg unit area^{-1} and lowest of 4.50 kg unit area^{-1} were observed in 60,000 and 30,000 population of maize ha^{-1} respectively (Table 1). The reason could be that more plant population so more biological yield, while for highest HI with minimum population all maize plant bore cobs whereas the thick plants were mostly barren and hence low economic yield. Similar results were also reported by Dias *et al.* (1995).

Data (Table 2) recorded on number of shoots stump^{-1} of sugarcane at experiment planting time (15th March) was non significant, while at 15th April were significantly ($P \leq 0.05$) different in all intercropped plots, while at 15th April maximum of 8.91 and minimum of 6.91 shoots stump^{-1} were recorded 30,000 and 60,000 maize plants ha^{-1}, respectively. The reason could be that there was no intercropping and hence no competition while after 30 days maize seeding nutrients and moisture were shared by both the crops and difference in the number of shoots stump^{-1} was visible. These results agree with findings of Wallac *et al.* (1991). Data concerning number of shoots stump^{-1} of sugarcane at 15th may and 15th June. Statistical analysis revealed that there was a significant difference in all intercropped plots, maximum of 11.33 and 12.08 and minimum of 8.66 and 10.16 shoots stump^{-1} were

Table 1: Data regarding growth and yield parameters of maize cultivar Sarhad white intercropped with sugarcane

Plant height (cm)	Number of leaves plant^{-1}	Cob length (cm)	Bareness (%)	Grains cob^{-1}	Grain weight (g)	Grain yield (kg ha^{-1})	Grain weight (g)	Grain yield (kg ha^{-1})	Harvest index (%)	Biological yield (kg ha^{-1})
164.40a	10.73a	19.20a	9.35b	205.20a	240.00a	2400.00a	240.00a	2400.00a	15.45a	4.50d
151.20b	9.70b	18.13ab	12.20b	180.00b	185.00b	1975.00b	185.00b	1975.00b	11.58b	5.37c
138.20c	8.87c	17.08b	9.70b	153.00c	163.80	1638.00b	163.80	1638.00b	9.23c	6.25b
133.60	8.37c	16.23b	18.90a	141.80c	122.50c	1225.00c	122.50c	1225.00c	7.41d	7.25a
11.50	0.791	1.96	3.17	13.97	40.92	340.43	40.92	340.43	1.78	0.82

Mean followed by different letters are significantly different from one another at P ≤ 0.05

Table 2: Data on number of shoots stump^{-1} of sugarcane at month's interval i.e., April, May and June 1999 as affected by different plant populations of maize cultivar Sarhad White intercropped with sugarcane

15th March	15th April	15th May	15th June
5.24	8.91a	11.33a	12.08a
4.66	8.33a	9.66b	11.16b
4.82	7.16b	8.91c	10.74bc
4.49	6.91b	8.66c	10.16c
N.S	-	0.734	0.596

Mean followed by different letters are significantly different from one another at P ≤ 0.05

Table 3: Number of water shoots of sugarcane in September 1999 and sugarcane height at maize harvest (cm)

No. of water shoots	Sugar cane height at maize harvest (cm).
0.57d	68.88a
1.49c	64.35b
1.82b	62.52b
2.31a	59.02c
0.29	1.95

Mean followed by different letters are significantly different from one another at P ≤ 0.05

recorded in 30,000 plants ha^{-1}, respectively. The probable reason could be that with less density (30,000 plants ha^{-1}) of intercrops, the competition for nutrients was not as much serve as in case of high density intercrop (60,000 plants ha^{-1}). These findings are confirmed by Saini and Singh (1994), who concluded from a field experiment that the sugarcane and maize intercrop showed good results when proper amount of nutrients were available. Statistical analysis (Table 3) indicated that there was a significant (P ≤ 0.05) difference in all the intercropped plots. Maximum (2.31) and minimum (0.57) water shoots stump^{-1} was observed in 60,000 and 30,000 plant population of maize ha^{-1} respectively. The reason could be that both maize and sugarcane were exhaustive crops due to this the competition for available nutrients was high, so higher number of water shoots were recorded where maize population was highest. More nutrients were available to the plants where maize population was low so height of sugarcane was maximum due to more vegetative growth. Maximum (68.88) and minimum (59.02 cm) sugarcane height at maize harvest were observed in 30,000 and 60,000 plants of maize ha^{-1}, respectively. This observation is in agreement with Govinden and Arnason (1990), who observed that the maize competed with the cane for light and that intercropping reduced cane yield.

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