

# Effect of some tillage practices and plant spacing on sugar cane productivity in sohag

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**SUMMARY**  
**EFFECT OF SOME TILLAGE PRACTICES AND PLANT SPACING ON SUGAR CANE PRODUCTIVITY IN SOHAG**

Two field trials were conducted at Shandaweel Research Station (Sohag Governorate) in two successive seasons of 1997/1998 and 1998/1999, to study the effect of some tillage practices (ploughing and hoeing) and row spacing on yield and quality of plant cane. Each field experiment included twelve treatments representing the combination between the studied factors: I- Number of ploughing (two, three and four ploughings). II- Row spacing (100 cm and 125 cm row spaces). III- Two hand hoeing treatments (hoeing twice and thrice). Sugar cane was planted during the first week of April and was harvested twelve months later. Sugar cane variety G.T.54-9 (the commercial variety) was used in both growing seasons of this study. One and half drills of three-budded cane cuttings were used in sugar cane planting (37800 buds/fed in case of spacing rows at 100 cm and 30240 buds/fed in case of 125 cm row spacing). Hoeing took place after 30, 60 and 90 days from planting in both seasons. A split split plot design with four replications was used in both seasons where, treatments of ploughing number were allocated in the main plots whereas row spacing treatments were assigned to the sub plots and hoeing levels were randomly distributed in the sub-sub plots. The experimental unit area was 70 m<sup>2</sup>, 7 m in length and 10 m in width, including 10 rows (in case of spacing rows at 100 cm) and 8 rows (in case of spacing at 125 cm). The results of the two growing seasons of the plant cane crop could be summarized as follows:

I : Effect of ploughing intensity :

- 1- Increasing ploughing number from two to three and four increased germination percentage at 45 days in both seasons with significant difference in the second season.
- 2- Increasing ploughing number from two to three and four increased number of stalks/m<sup>2</sup> after 105 and 165 days from planting. The increase was more evident at 165 days.
- 3- Increasing ploughing number from 2 to 4 times significantly increased stalk diameter (cm) at 150 and 210 days in the second season.
- 4- Ploughing two and/or three times attained the highest stalk length, in both seasons and throughout the different growth stages compared with four ploughings.
- 5- Ploughing intensity significantly affected grassy weeds dry weight in the first season where a significant increase was recorded with the increase in ploughing frequency. This effect was mainly due to the presence of Bermuda grass in the experimental site and frequent ploughing led to great distribution of the rhizomes in the soil. In regard to total weed density, no significant effect was detected for ploughings in both seasons.
- 6- The highest values of N% of sugar cane leaves were attained by ploughing sugar cane field twice and thrice. Significant differences in N% in leaves were observed at 150 days in the first season and at 330 days in both seasons.
- 7- The effect of ploughing number on K% in sugar cane leaves was significant at 210 and 270 days in the 1st season and at 150 days after planting in the 2nd season. Ploughing sugar cane field twice produced the highest values of K% in the 1st season at 210 and 270 days.
- 8- Ploughing intensity did not affect Na% in leaves at the different growth stages in both seasons.
- 9- Ploughing significantly affected N% in sugar cane stalk at harvest in 1998/99 season and the highest N% was observed with 3 ploughings.
- 10- The lowest value of Na % of sugar cane stalk at harvest was obtained by ploughing twice in the 1st season and by ploughing 4 times in the 2nd season, with significant differences.
- 11- The lowest value of K % of sugar cane stalk (0.72 % and 0.570/0) at harvest was recorded by ploughing sugar cane field 4 times in the 1st and 2nd seasons respectively. Significant differences were observed in the

first season. 12- Increasing ploughing from two to three and four times decreased fiber 0/0 in stalk at harvest in the first and second seasons. 13- The total soluble solids percentage (TSS 0/0) values in juice were significantly affected by ploughing treatments at 150 and 210 days in the 1st season and at 330 days in the 2nd season. Increasing ploughing frequency generally increased TSS% in sugar cane juice. 14- Number of ploughing significantly affected brix% in juice at harvest in both seasons. The four ploughings treatment produced the highest brix percentage in the second season. However, in the first season, ploughing twice produced the highest brix%. 15- Increasing ploughing intensity significantly increased sucrose % in juice at harvest in the first seasons only. However, the highest sucrose percentage was recorded in both seasons with the highest number of ploughings (four times). 16- Ploughing intensity did not significantly affect reducing sugar % in juice at harvest in both seasons. 17- The highest purity and sugar recovery percentages were recorded in both seasons with the highest number of ploughing, with significant differences in the second season. 18- Increasing ploughing number from two to three and four times increased number of millable cane by 17.6 and 27.260/0 in the 1st season, being 6.060/0 and 15.33 % in the 2nd one. The effect of ploughing intensity on number of millable cane/fed was significant in the 1st season only. 19- Increasing ploughing number from two to three and four times increased cane yield by 16.4 % and 24.9 % respectively, in the 1st season, corresponding to 6.21 % and 13.42 % in the 2nd season. 20- Increasing ploughing number from two to three and four times increased sugar yield by 29.28 % and 48.43 % respectively, in the 1st season corresponding to 5.98 % and 22.16 % in the 2nd season.

**II : Effect of row spacing:**

1- Using row spacing of 100 cm produced higher germination percentage in both seasons compared with row spacing (125 cm). The increase was significant in the second season. 2- Row spacing of 100 cm significantly increased number of stalks/m<sup>2</sup> after 105 and 165 days from planting in both seasons compared with planting at 125 cm. 3- Row spacing of 125 cm significantly increased stalk diameter in the 2nd season at the various growth stages. However, effect of row spacing on this trait was significant at 150 days- in the 1st season. 4- Using row spacing of 100 cm significantly increased stalk height at the different stages in the 2nd season compared with the wider row spacing (125 cm). Also, in the 1st season, row spacing of 100 cm increased stalk height compared with 125 cm at 150 days from planting. 5- Neither fresh weight nor dry weight of the different weed groups, as well as the total weeds fresh and dry weight were significantly affected by row spacing in both seasons. 6- Row spacing significantly affected N % in leaves at 270 days in the 1st season as well as at 330 days in the second one. Higher N% in leaves was recorded at 100 cm row spacing after 270 days in 1997/98 season, whereas higher N% in leaves was recorded at 330 days in 1998/99 season. 7- K % in leaves at 150 days in the 1st season as well as at 210 days in the second one was significantly affected by row spacing. 8- Na % of sugar cane leaves was not significantly affected by row spacing at different stages in both seasons. 9- The effect of row spacing on N % of sugar cane stalk at harvest was not significant. 10- Na % in stalk at harvest was significantly affected by row spacing in 1998/99 season. A higher Na% was recorded at wider row spacing. 11- The wider row space (125 cm) produced lower value of K % of sugar cane stalk (0.72 %) at harvest in the 1st season. 12- Fiber % in sugar cane stalk at harvest was not significantly affected by row spacing. 13- Row spacing significantly affected TSS % in juice at 210, 270 and 330 days from planting in 1998/99 season. An increase in TSS% was observed at 125 cm row spacing compared with 100 cm. 14- Brix % of sugar cane juice at harvest was not significantly affected by row spacing. 15- Sucrose percentage in sugar cane juice at harvest significantly increased at 125 cm row spacing in 1998/99 season compared with 100 cm row spacing. 16- Reducing sugars, purity and sugar recovery percentages in sugar cane juice at harvest were not significantly affected by row spacing in both seasons. 17- Spacing cane rows at 100 cm width produced higher number of millable cane/fed, by 3.78 % and 6.24 % in the 1st and 2nd seasons, compared with 125 cm in both seasons. However, these increases were below the level of significance. 18- Cane yield increased by 4.13 and 6.13 % in the 1st and 2nd seasons, respectively by planting row 100 cm over 125 cm. The increases in both seasons were below the significant level. 19- Row space of 100 cm insignificantly increased sugar yield by 6.93 % and 3.43 % in the 1st and 2nd season, respectively.

**III : Effect of hoeing:**

1- Hoeing frequency had no significant effect on number of stalks/m<sup>2</sup> at 105 and 165 days from planting

in both seasons.2- Increasing hoeing from two to three times increased stalk diameter in the both seasons at all growth stages.3- Hoeing treatments did not significantly affect stalk height at the different growth stages in both seasons.4- Three hoeing reduced the spread of weeds compared with two hoeing at 135 days. The reductions in fresh and dry weights of total weeds were 57 and 51 % in the first season, respectively, corresponding to 25 and 26 % in the second season.5- There was no significant effect of hoeing frequency on N % in leaves at the different growth stages in the two seasons, except when the plant aged 270 days in the 2nd season where hoeing sugar cane plant three times recorded highest value with respect to N % of sugar cane leaves.6- Hoeing sugar cane plant twice a season increased K% in leaves in the 1st season compared with 3 hoeings at 150 and 210 days while at 270 days hoeing three times increased K% compared with hoeing twice. 7- Hoeing twice significantly increased Na% in leaves at 330 days in the first season, At the other growth stages in that season as well as at all stages in the second one, no significant effect for hoeing was detected.8- Hoeing sugar cane plant twice a season significantly increased N % of sugar cane stalk at harvest compared with hoeing three times in both seasons.9- Hoeing treatments did not significantly influence K% in sugar cane stalk at harvest in both seasons.10- Hoeing frequency had no significant effects on fiber % in stalk at harvest in both seasons.11- There was a general positive response in the values of TSS % in juice in both seasons to hoeing sugar cane plants twice a season compared with 3 hoeings. The significant effect of hoeing treatments was recorded at the 1st growth stage (150 days) in the 2nd season.12- Hoeing treatments did not significantly influence brix % in sugar cane juice at harvest in both seasons.13- Two hoeings produced higher sucrose percentage in juice at harvest in both seasons compared with three hoeings. This effect was significant in the second season.14- Hoeing frequency had no significant effects on reducing sugars %, purity% and sugar recovery % in juice at harvest in both seasons.15- Practicing three hoeings insignificantly produced higher number of millable cane/fed in both seasons. The increases were 2.6 and 3.4 % in the first and second season, respectively, compared with 2 hoeings.16- Practicing three hoeings insignificantly produced higher cane yield /fed in both seasons. This increase was 2.77 and 3.34 % compared with two hoeings in the 1st and 2nd season, respectively.17- Hoeing frequency had no significant effect on sugar yield in both seasons.

IV : Interaction effects: The following Tables (30 and 31) show the significant interactions: Table (30) The highest response values and combination of factors of the interaction effects of the studied characters of sugar cane in 1997/98 season

Characters	Interactions	Pl. X Spac.	Pl. X Hoe.	Spac. X Hoe.	Spac. X Pl.	Hoe. X Pl.
Stalk height (cm)	213.65 cm	S	NS	NS	211.63 cm	S
Stalk height (cm)	303.24 cm	S	NS	NS	315.90 cm	S
Stalk height (cm)	344.66 cm	S	NS	NS	3.37%	S
N % in leaf	3.52%	S	NS	NS	2.52%	S
N % in leaf	2.47%	S	NS	NS	2.15%	S
N % in leaf	2.01%	S	NS	NS	2.18%	S
Na % in leaf	0.619%	S	NS	NS	0.64%	S
Na % in leaf	0.65%	S	NS	NS	1.92%	S
N % in stalk	1.92%	S	NS	NS	1.83%	S
TSS O/O	14.99%	S	NS	NS	0.55%	S
Reducing sugar	0.55%	S	NS	NS	0.53%	S
Purity %	87.00%	S	NS	NS	12.33%	S
Sugar recovery	12.33%	S	NS	NS		

Table (30) shows the best combinations between the studied factors in 1997/98 season and the recorded values. Ploughing intensity X spacing significantly affected stalk height at DFP, N% in leaf at 210, 270 and 330 DFP, Na % in leaf at 330 DFP, N% in stalk at harvest, reducing sugar % at harvest and sugar recovery %. Combining 4 ploughings + 100 cm spacing recorded, mostly, the highest values. Ploughing intensity X hoeing treatments had significant effects on N% in leaf at 270 DFP, K% and Nit % in leaf at 210 DFP, Na % in leaf 270 DFP, N% in stalk at harvest and reducing sugar % at harvest. Almost, combining 2 ploughings + 2 hoeings recorded the highest values. Spacing X hoeing significantly affected on stalk height at 150 and 270 DFP, N% in leaf at 330 DFP, Na % in leaf at 150, 210 and 270 DFP, TSS % at 150 DFP and

reducing sugar % in juice at harvest. Combining 100 em spacing + 2 hoeings enhanced growth characters, whereas 125 em spacing + 3hoeings increased absorption of nutrients. The second order interaction had significant effects on stalk height at 270 and 330 DFP, N% in leaf at 150 DFP, Na % in leaf at 150, 210 and 270 DFP and N% in stalk at harvest. Combining 2 ploughings + 125 em spacing + 2 hoeings almost recorded the highest values. Table (31) The highest response values and combination of factors of the interaction effects of the studied characters of sugar cane in 1998/99 season.

Characters Interactions PI. X Spae, PI. X Hoe. Spac, X Hoe. PI. X Spac. X Hoe. Germination % 40.87% S NS NS NS at 45 DFP 3 pl. X 125 em Stalk diameter 2.60 em S NS NS NS at 270 DFP 2 pl. X 125 em Stalk diameter 2.98 em S NS NS NS at 330 DFP 3 pl. X 125 em Stalk height (em) NS NS 199.37 em S NS at 150 DFP 100 em X 3 hoe. Stalk height (em) NS 232.9 em S NS NS at 210 DFP 3 pl. X 3 hoe. Stalk height (em) 294.13 em S 288.38 em S NS NS at 270 DFP 3 pl. X 100 em 3 pl, X 3 hoe. N % in leaf NS 2.48% S NS NS at 210 DFP 4 pl. X 3 hoe. N % in leaf NS NS NS 2.60% Sat 330 DFP 3 pl, X 125 cm X 2 hoe. K % in leaf NS . NS 2.33% S 2.47% Sat 150 DFP 125 em X 2 hoe. 2 pl, X 125 em X 2 hoe. K % in leaf NS 2.53 % S NS 2.74% Sat 210 DFP 3 pl. X 3 hoe. 3 pl. X 100 cm X 3 hoe. K % in leaf NS NS NS 2.28% Sat 270 DFP 2 pl. X 100 em X 3 hoe. K % in leaf 1.82 % S 1.73 % S NS NS at 330 DFP 3 pl. X 100 em 3 pl, X 2 hoe. Na % in leaf NS 0.79% S 0.76% S NS at 150 DFP 3 pl. X 3 hoe. 100 em X 3 hoe. Na % in leaf 0.82% S NS NS NS at 210 DFP 2 pl. X 100 em Na % in leaf NS 0.63 % S NS NS at 270 DFP 2 nl, X 2 hoe. Na % in leaf 0.57% S 0.63 % S 0.55 % S 0.71 % S at 330 DFP 2 pl. X 125 em 2 pl. X 2 hoe. 125 em X 3 hoe. 2 pl. X 100 em X 2 hoe. N % in stalk NS 1.80 % S 1.57 % S 2.00% S ., at harvest 3 pl. X 2 hoe. 100 em X 2 hoe. 3 pl. X 100 em X 2 hoe. K % in stalk NS NS 0.69% S NS at harvest 100 em X 3 hoe. Fiber % in stalk NS 12.50 % S NS 12.77 % Sat harvest 2 nl, X 3 hoe. 2 pl. X 100 em X 3 hoe. TSS% NS 15.05 % S NS NS at 150 DFP 2 pl. X 2 hoe. TSS% 17.74 % S NS 17.63 % S 18.23 % Sat 210 DFP 2 pl. X 125 em 125 em X 3 hoe. 4 pl, X 125 em X 3 hoe. TSS% 19.55 % S 18.85 % S 18.90 % S 19.63 % Sat 270 DFP 2 pl. X 125 em 2 pl. X 2 hoe. 125 em X 3 hoe. 2 nl, X 125 em X 3 hoe. TSS% 22.55 % S NS NS 23.07 % Sat 330 DFP 2 pl, X 125 em 4 pl, X 100 em X 2 hoe. Sucrose % in NS NS NS 18.86 % S juice at harvest 4 pl. X 125 em X 2 hoe. Reducing sugar NS NS NS 0.72% S % at harvest 2 pl. X 125 em X 3 hoe. Purity % in NS 88.50 % S NS NS juice at harvest 2u1 X 2 hoe. Sugar recovery NS 12.14 % S NS 12.65 % S % in juice 2u1 X 2 hoe. 4 pl. X 125 cm X 2 hoe.

In 1998/99 season, the significant interactions presented in Table (31) indicated that ploughing X spacing significantly affected germination % at 45 DFP, stalk diameter at 270 and 330 DFP, stalk height at 270 DFP, K% in leaf at 330 DFP, Na % in leaf at 210 and 330 DFP and TSS % at 210, 270 and 330 DFP. The highest values of growth traits were almost recorded by combining 3 ploughings + 125 em, whereas combining 2 ploughings + 125 em produced the highest values of the chemical contents. Ploughing X hoeing had significant effects on stalk height at 210 and 270 DFP, N% in leaf at 210 DFP, K% in leaf at 210 and 330 DFP, Na% in leaf at 150, 270 and 330 DFP, N% in stalk at harvest, fiber % at harvest, purity % and sugar recovery % in juice at harvest. Combining 3 ploughings + 2 hoeings, generally, increased these traits. Concerning spacing X hoeing, Table (31) showed that this interaction significantly affected stalk height at 150 DFP, K% in leaf at 150 DFP, Na % in leaf at 150 and 330 DFP, TSS % at 210 and 270 DFP and N% and K% in stalk at harvest. Combining 125 cm spacing + 3 hoeings recorded the highest values of the chemical contents in general. The second order interaction significantly affected N% in leaf at 330 DFP, K% in leaf at 150, 210 and 270 DFP, Na % in leaf at 330 DFP, N% in stalk at harvest, fiber % in stalk at harvest, TSS % at 210, 270 and 330 DFP, reducing sugar % in juice at harvest and sugar recovery % in juice. In general, the highest values were recorded by combining 4 ploughings + 100 em ( and 0 em) spacing + 2 hoeings.