PLANT CROP RESULTS OF A ROW SPACING EXPERIMENT AT PONGOLA

by J. P. BOYCE

South African Sugar Association Experiment Station

Introduction

The results of row spacing experiments conducted in Natal under favourable soil moisture conditions show that at adequate fertilizer levels there is a persistent trend towards higher yields at closer spacings (Thompson and du Toit[4]). Increased yields were associated with higher stalk populations although the stalks were both thinner and lighter than the stalks from widely spaced cane. The mean yields for 23 crops were 64.4 tons cane per acre (T.C.A.) at 1 ft. 6 in. row spacing, 63.0 T.C.A. at 3 ft. spacing and 60.3 T.C.A. at 4 ft. 6 in. spacing, the average crop age being 13 months. Over the range from 4 ft. 6 in. to 3 ft. spacing, the average increase in yield per foot decrease in row width for 28 crops was estimated to be 1.94 T.C.A. per annum or 5.4 per cent. For 11 plant crops the average estimated increase was 1.88 T.C.A. per annum (3.3 per cent), in contrast to values of 2.77 T.C.A. per annum (8.5 per cent) for 8 first-ratoon crops and 0.59 T.C.A. per annum (1.9 per cent) for 8 second-ratoon crops. Sucrose per cent cane was not markedly influenced by row spacing under these conditions, although at 1 ft. 6 in. row spacing the results were less consistent. The varieties used included N:Co.376, N:Co.310, N:Co. 334, N:Co.293, N:Co.382, N.50/211, N.58/2239 and N.58/2242.

Different levels of fertilizer were used in some of these experiments. The results showed that the interaction between row spacing and fertilizer level was not consistently positive and that at high levels of fertilizer application the tendency for yield to increase with decreasing row spacing could be reversed. Thompson and du Toit[4] ascribed this reversal to excessive stalk mortality associated with moisture stress, rather than with competition for light. It was acknowledged that the consumptive use of water by a crop generally increased at closer row spacings due to earlier canopy formation and that it also increased with heavier fertilizer applications.

Sugarcane is grown on 875,000 acres of land on the Natal coast and in the Eastern Transvaal but only 15 per cent of this area is irrigated. There are about 50,000 acres under supplementary irrigation south of Mtubatuba where rainfall limits the average production to less than 20 T.C.A. per annum. Approximately 53,000 acres are grown under irrigation north of Mtubatuba, mainly at Pongola and Malelane. The row spacing adopted in these areas varies from 3 ft. to 6 ft. with much of the cane planted at 4 ft. 6 in. or 5 ft. row spacing.

Since all existing studies on spacing, and its effect on yield, have been carried out on the Natal coast, it was decided that similar work should be carried out at Pongola. The relevant experiment, designed to measure the effects of row spacing under heavily irrigated conditions is described here.

Treatments

The experiment was planned to study the effects of a wide range of row spacings and responses to planting cane either in furrows or on ridges. It consists of four replications of split plot design, with 6 row spacings as whole-plot factors and the comparison of standard furrow-planting with ridge-planting as sub-plot factors.

The basic plot layout was related to the 60 ft. x 60 ft. spacing of the overhead irrigation system on the Pongola Field Station. With 10 ft. breaks for the irrigation laterals, the rows adjacent to the lateral breaks were always 5 ft. from the pipes themselves, so that the cane was grown in strips 50 ft. wide, bounded by the laterals. Row spacings were calculated to give 7, 9, 11, 13, 15 and 17 spaces for the available 50 ft., which in turn gave whole plots between each lateral consisting of 8, 10, 12, 14, 16 and 18 rows. These whole plots were then split for each planting method. The treatments were as follows:

(i) Row spacings

S_1 : 7′ 2″	S_4 : 3′ 10″
S_2 : 5′ 7″	S_5 : 3′ 4″
S_3 : 4′ 6″	S_6 : 2′ 11″

(ii) Planting method

H_0 : Standard 8 inch furrows

H_1 : Variable sized ridges

The length of the plots was also related to the 60 ft x 60 ft. spacing of the irrigation sprinklers. With 5 ft. breaks half-way between the sprinklers, the remaining 55 ft. available was split to give two whole plots 27 ft. 6 in. long with the net plots 20 ft. long.

In order to provide yield data for a 60 ft. x 60 ft. overhead irrigation system in "field practice", the guard rows adjacent to the laterals were harvested separately. Taking into account only the net plot yields, the data represented productivity from a complete stand of cane uninterrupted by pipelines and, in this context, only comparable with flood irrigation. By including the weight of the guard rows and increasing the plot size to include the full 60 ft. distance between laterals, it was possible to obtain data representing overhead irrigation conditions in field practice. However, it is pertinent to point out that with different row spacings, the contribution of the guard rows under overhead irigated conditions will vary according to their ability to utilise the extra resources in the 10 ft. breaks.

Procedures

The standard furrows were drawn with the bottom of each furrow approximately 8 inches below the top of the ridges. The ridges, on the other hand, were initially drawn with the top of each ridge approximately 9 inches above the bottom of the furrow, and a small furrow 4-5 inches deep was then drawn along the top of each ridge. Subsequently these ridges were broadened according to the row spacing without increasing the amount of soil above the planting furrow. The wider the row spacing, the broader were the ridges, but the depth of the furrows between ridges at the wider spacings was also increased when larger amounts of soil were used to broaden the ridges.

Fertilizer was applied evenly along each planting furrow at rates of 50 lb. N per acre (46 per cent Urea) and 83 lb. P per acre (8.3 per cent Supers) and was covered lightly with soil. The experiment was planted on 6th December, 1966, with locally-grown seedcane of the variety N:Co. 376 which had previously been heat-treated. After dipping in a solution of fungicide and insecticide, the three-eyed setts were laid continuously along each furrow and covered with about 2 inches of soil which was then well compacted. Immediately after planting, the experiment was irrigated. Six weeks after planting, all plots were topdressed with 100 lb. N per acre (46 per cent Urea) and 50 lb. K per acre (50 per cent Muriate of Potash) applied along each row of cane.

The experiment was irrigated to the estimated potential requirements shown in Table 1. The stage of growth for each monthly period was determined according to the development of the crop canopy of the closest row spacing. Assuming a value of 4 in. for the total available moisture (T.A.M.) a balance sheet was maintained taking into account evapotranspiration, rainfall and irrigation applications. The experiment was irrigated at a deficit of 2.40 in. with an equivalent amount applied over a 12 hour period. Overhead irrigation was considered to be 80 per cent. efficient and rainfall in excess of the T.A.M. was considered to be ineffective. Provision was made to modify the estimates of potential evapotranspiration in the light of Class A Pan evaporation data from an adjacent meteorological site. The estimate of 0.20 in. per day for October was increased to 0.23 in. per day in Mid-October and the value of 0.22 in. per day for November was increased to 0.25 in. per day. No drying-off procedures were carried out prior to harvesting.

TABLE 1

Estimates of potential evapotranspiration at Pongola for 1966—1967

Month	Bare soil +				Full Canopy
	No Canopy	1/4 Canopy	1/2 Canopy	3/4 Canopy	
January	0.11	0.15	0.20	0.23	0.28
February..	0.11	0.15	0.19	0.23	0.27
March	0.09	0.12	0.16	0.20	0.23
April	0.07	0.10	0.13	0.16	0.18
May..	0.06	0.08	0.10	0.12	0.14
June..	0.04	0.06	0.07	0.09	0.10
July	0.04	0.06	0.08	0.10	0.12
August	0.05	0.07	0.09	0.10	0.12
September	0.07	0.10	0.12	0.15	0.17
October	0.08	0.11	0.14	0.17	0.20
November	0.09	0.12	0.16	0.19	0.22
December	0.10	0.14	0.17	0.21	0.24

The rate of growth of the crop was determined by means of stalk heights measured weekly on ten selected stalks per plot, from the top of a reference peg to the uppermost visible collar. Tillering and mortality patterns were followed by taking shoot and stalk counts weekly in summer and monthly in winter. Vertical ground cover was measured as a percentage, using the method described by Cackett[1], but separate measuring devices were used for each row spacing. The nutritional status of all plots was assessed by means of leaf samples taken during April, 1967.

The experiment was harvested on 20th November, 1967, when the crop was almost 12 months old. The standing cane was pre-trashed and topped by hand at the base of the 5th leaf sheath. Each net plot was cut and the stalks were weighed and counted, one in ten stalks being set aside for measurement of crop characteristics. These stalks were measured for length and diameter at the bottom, middle and top of each stalk. A sample of ten of these stalks was taken randomly for juice analysis. The guard rows adjacent to the laterals were cut and weighed separately, the number of stalks in each row being recorded. No other measurements or sucrose samples were taken from the guard rows.

Results

The data for yields and crop characteristics, together with the standard errors of treatment means and least significant differences between treatment means at 5 and 1 per cent levels, are shown in Tables 2 and 3. The stalk diameter data are presented in Fig. 1, illustrating the trends from the bottom of the stalks to the top. The development of the crops in terms of population counts and ground cover is shown in Figs. 2 and 3 for specific row spacings.

The mean yield and population data for a 60 ft. x 60 ft. overhead irrigation system are shown in

TABLE 2
Mean yield data for flood-irrigated conditions

Treatment	Tons Cane/Acre			Sucrose % Cane			Tons Sucrose/Acre		
Row Spacings	Furrow	Ridge	Mean	Furrow	Ridge	Mean	Furrow	Ridge	Mean
7' 2"	50.8	47.7	49.3	11.19	11.17	11.18	5.69	5.35	5.52
5' 7"	52.4	52.6	52.5	11.56	11.35	11.46	6.08	5.97	6.03
4' 6"	56.5	54.1	55.3	11.38	11.32	11.35	6.43	6.12	6.28
3'10"	55.4	54.6	55.0	10.71	11.02	10.87	5.92	6.01	5.97
3' 4"	59.0	53.5	56.3	10.97	11.47	11.22	6.47	6.15	6.31
2'11"	60.5	56.6	58.6	10.55	11.37	11.46	6.98	6.41	6.70
Means	55.8	53.2	54.5	11.23	11.28	11.26	6.26	6.00	6.14
S.E.			1.28			0.204			0.149
L.S.D. (0.05)			3.9			0.61			0.45
(0.01)			5.3			0.85			0.62

TABLE 3
Populations and harvested crop characteristics for flood-irrigated conditions

Treatment	Population ($X10^{-3}$)			Stalk Length (ft)			Stalk Weight (lbs)		
Row Spacings	Furrow	Ridge	Mean	Furrow	Ridge	Mean	Furrow	Ridge	Mean
7' 2"	52.6	50.4	51.5	6.06	5.92	5.99	1.93	1.91	1.92
5' 7"	56.9	59.7	58.3	5.91	5.64	5.78	1.85	1.77	1.81
4' 6"	58.8	61.5	60.2	5.85	5.84	5.85	1.95	1.77	1.86
3'10"	64.6	65.8	65.2	5.87	5.66	5.77	1.71	1.66	1.69
3' 4"	67.6	70.6	69.1	6.18	5.65	5.92	1.75	1.51	1.63
2'11"	69.9	73.1	71.5	6.07	5.68	5.88	1.75	1.55	1.63
Means	61.7	63.5	62.6	5.99	5.93	5.89	1.82	1.70	1.76
S.E.			1.51			0.069			0.037
L.S.D. (0.05)			4.6			0.21			0.11
(0.01)			6.3			0.29			0.15

Table 4, together with the separate yield data for the guard rows adjacent to the laterals. The guard row yields were calculated using a row width value determined by adding the actual row spacing to the remaining distance to the centre of the 10 ft. breaks.

The degree of compensation achieved by the guard rows at different spacings is illustrated in Table 5. These guard row yields were calculated using a row width value equal to the actual row spacing.

Discussion

Effects of row spacing on furrow-planted cane:

The average increase in yield per foot decrease in row width for furrow-planted cane was 2.28 T.C.A. per annum (4.5 per cent). This result compares favourably with the estimate from 11 plant crops of 1.88 T.C.A. per annum (3.3 per cent) for each foot decrease in row width. Thompson[2] stated that where moisture was not a limiting factor during the development of the crop, an increase of more than 5 per cent in cane yield was obtained for each foot reduction in row spacing, from 5 ft. 3 in. down to 1 ft. 6 in.

Row spacing had no appreciable effect on sucrose per cent cane. The yields of sucrose per acre were therefore dependent upon the yield of cane. The increased yield at closer row spacings was associated with higher populations of thinner and therefore lighter stalks, there being no apparent difference in stalk length at different row spacings (Table 3). From Fig. 1 it is evident that the stalks were thinner in the middle than at the bottom and that the effect of row spacing on stalk diameter was a little more pronounced on the middle of the stalks than on the bottom. Similarly, the stalks were much thicker at the top than at either the bottom and middle and the effect of row spacing on diameters at the top of the stalks was very much more severe than the effect on both the middle and bottom. The closer the row spacing and the higher the maximum populations, the thinner were the stalks. It is of interest that under irrigated conditions, there appears to be a reversal of the expected trend in stalk diameter as described by Thompson and du Toit[4] for rain-fed cane when moisture was severely limiting. They found that the "differences in stalk diameter due to spacing treatments decreased from the bottom of the stalk to the top as would be expected in view of the progressively decreasing populations during their periods of formation".

Population counts during the development of the crop, which are reflected in Fig. 2 for treatments S_1, S_3, S_5 and S_6, showed that where higher populations were generated at closer spacings the percentage mortality was also higher, but that a greater number of stalks survived. The ground cover measurements, shown in Fig. 3 for treatments S_1, S_2, S_5 and S_6 reflect the relative degrees of

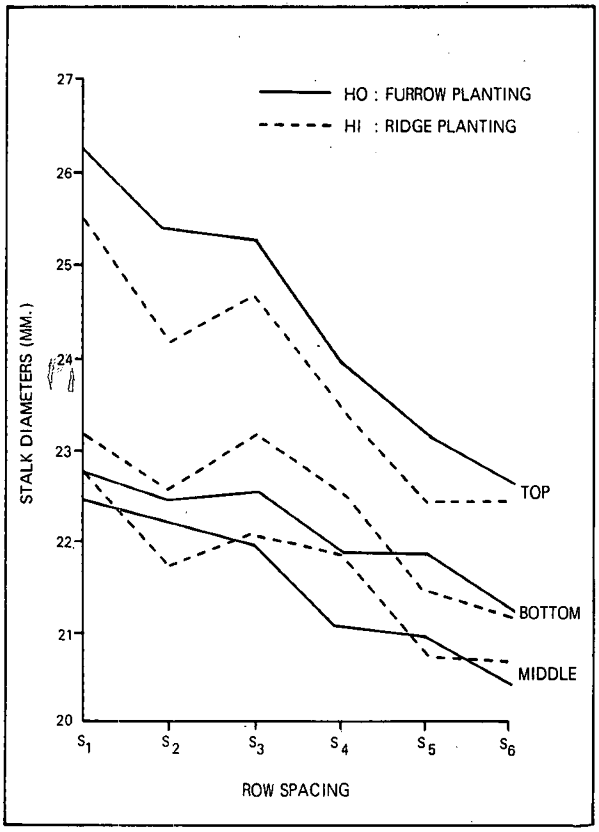

FIGURE 1: The effects of row spacing on stalk diameters of bottom, middle and top sections with furrow and ridge planting.

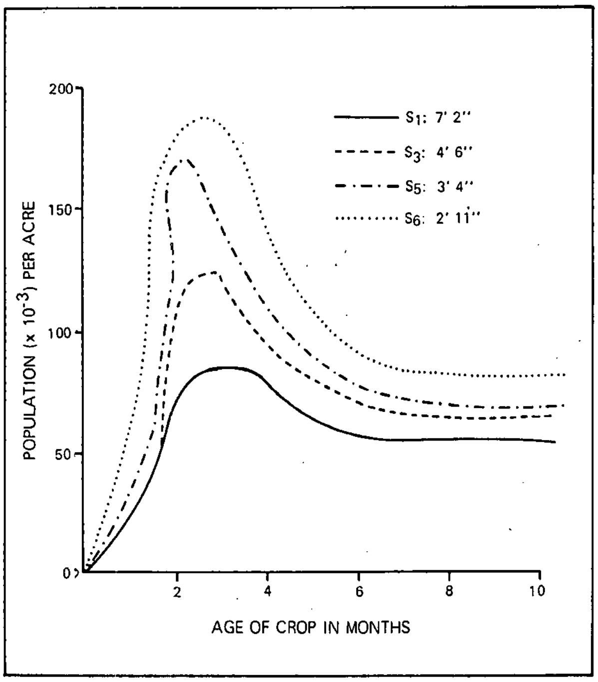

FIGURE 2: The effects of row spacing on population counts (Planted 6/12/66).

canopy development achieved at the different row spacings with time. The predominance of the within-row shading effect, described previously by Thompson and du Toit[4], is particularly marked for the wider row spacings, as shown by comparing Fig. 2 with Fig. 3. Mortality must have been due mainly

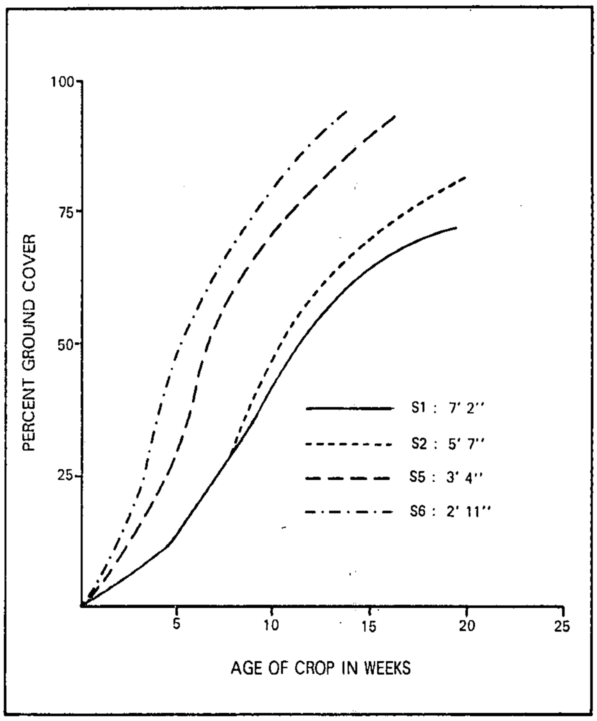

FIGURE 3: The effects of row spacing on ground cover (Planted 6/12/66).

to within-row shading since the high level of stalk mortality occurred almost simultaneously at all spacings, despite the fact that ground cover or the between-row development of canopy proceeded at a much reduced rate at the wider row spacings.

To evaluate the soil moisture conditions under which the crop developed, a monthly soil moisture balance was calculated. This is shown in Fig. 4 where Class A Pan evaporation, irrigation plus rainfall and estimated potential evapotranspiration values for monthly periods are plotted on the same scale against time. Assuming a 1 : 1 ratio of potential evapotranspiration to Class A Pan evaporation it is clear that potential evapotranspiration was underestimated from June to November. The daily balance sheet calculated from Class A Pan data shows that in May and June the deficit did not exceed 4.00 in. In view of the slow growth rate and low evaporative demand at this time of year, yields were probably not affected. During August, September and October, however, the available soil moisture reached zero for periods of 9, 9 and 3 days respectively. Although yield losses may have occurred there was no visible response to moisture stress by cane in the different spacing treatments in terms of growth rate and population counts. At no stage was the most closely planted cane observed to be wilting. The stalk height and gypsum block data for an adjacent irrigation experiment, with rows spaced at 5 ft. confirmed that soil moisture was not severely limiting in cane irrigated at approximately the same frequency as in this experiment (Thompson and Boyce[3]).

Comparison of furrow-planted vs. ridge-planted cane:

The yield data in Table 2 indicate that with row spacings from 7 ft. 2 in. to 3 ft. 10 in. there was no apparent difference between planting methods. However, at spacings of 3 ft. 4 in. and 2ft. 11 in.,

TABLE 4
Mean yield data for a 60ft x 60ft overhead irrigation system at Pongola

Treatments		Net Plot + Guard Row						Guard Row		
		Tons Cane/Acre			Population (X10^{-3})			Tons Cane/Acre		
Row Spacing	Rows per 60ft	Furrow	Ridge	Mean	Furrow	Ridge	Mean	Furrow	Ridge	Mean
7′ 2″	8	49.0	47.2	48.1	50.4	49.0	49.7	44.7	45.8	45.3
5′ 7″	10	50.7	50.3	50.5	53.9	56.3	55.1	45.7	43.5	44.6
4′ 6″	12	52.6	51.4	52.0	54.8	56.0	55.4	40.1	43.1	41.6
3′10″	14	52.3	51.9	52.1	59.7	61.6	60.7	42.1	43.1	42.6
3′ 4″	16	54.3	50.0	52.1	61.6	64.9	63.3	37.8	38.0	37.9
2′11″	18	56.8	51.8	54.3	65.5	66.9	66.2	43.3	34.7	39.0
Means		52.6	50.4	51.5	57.7	59.1	58.4	42.3	41.4	41.9
S.E.				1.17			1.32			1.56
L.S.D. (0.05)				3.5			4.0			4.7
(0.01)				4.9			5.3			6.5

TABLE 5
Compensation for overhead irrigation layout losses by increased growth of rows adjacent to laterals.

Row Width			Yield (T.C.A.)			Population (X10^{-3})		
Net	Guard	Guard/ net %	Net	Guard	Guard/ net %	Net	Guard	Guard/ net %
7′ 2″	8′ 7″	119.9	50.8	53.7	105.7	52.6	53.8	102.3
5′ 7″	7′ 9″	139.9	52.4	64.0	122.1	56.9	63.4	111.4
4′ 6″	7′ 3″	160.0	56.5	64.2	113.6	58.8	67.8	115.3
3′10″	6′11″	180.0	55.4	75.7	136.6	64.6	77.4	119.8
3′ 4″	6′ 8″	200.0	59.0	75.6	128.1	67.6	81.4	120.4
2′11″	6′ 6″	220.0	60.5	95.4	157.7	69.9	109.0	158.6
			55.8	71.4	128.0	61.7	75.5	122.4

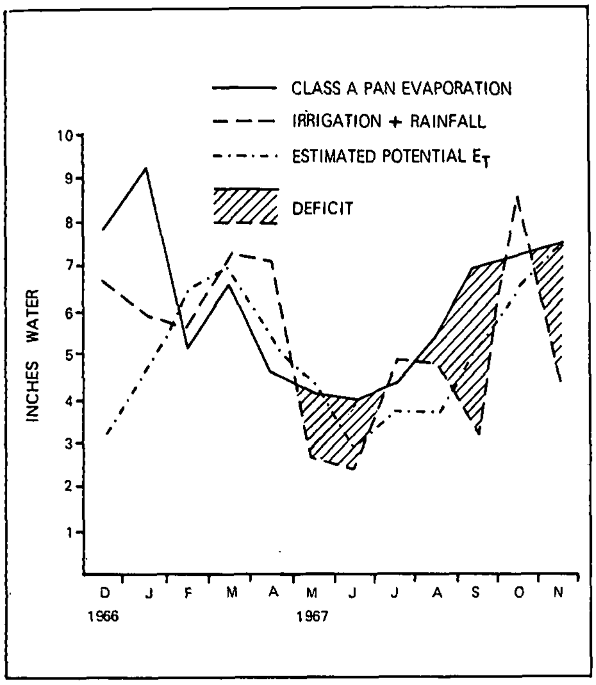

FIGURE 4: Class A Pan evaporation, irrigation + rainfall and estimated potential evapotranspiration for monthly periods showing "apparent" deficits.

the yield differences between furrow and ridge-planted cane were respectively 5.5 and 3.9 T.C.A. The decreased yield with ridge-planting was associated with higher populations of shorter stalks which were thinner at the top (Fig. 1) and these effects resulted in lighter stalks. These effects are ascribed to lodging which first occurred in mid-June when strong winds caused severe lodging in Replication I and slight lodging in Replication II. This lodging was associated with wet soil conditions since the irrigation lateral between Replications I and II had been operating for several hours when the winds occurred. In early July growth measurements in Replication I were discontinued because of the lodging. An assessment of lodging in early August indicated that there was lodging at all row spacings, especially in Replications I and II. However, at the closest row spacings, namely 3 ft. 4 in. and 2 ft. 11 in., the severe lodging of ridge-planted cane was evident in 3 replications of the former treatment and 2 replications of the latter. In contrast, severe lodging with furrow-planting was found in only one replication at each spacing. It seems, therefore, that the reduced yields from ridge-planted cane can be attributed to lodging.

Losses due to overhead irrigation layout:

The loss of yield with a 60 ft. x 60 ft. overhead irrigation layout due to the presence of a 10 ft. break every 60 ft., is shown by comparing the data in Tables 2 and 4. The loss amounted to approximately 3 T.C.A. per annum over all row spacings. The yield loss was associated with a decreased stalk population. It also varied with row spacing as shown by the guard row yields, which were calculated using a row width derived by adding the actual row spacing to the remaining distance to the centre of the 10 ft. break. The yield loss was comparatively greater at closer row spacings but there must have been greater compensation of yields by the guard rows at closer row spacings.

In order to determine the degree of yield compensation at different row spacings, the guard row yields and populations were recalculated using the actual row spacings for the row-width factor. The results are shown in Table 5 where the degree of compensation is clearly evident for both yield and stalk populations, particularly at the 2 ft. 11 in. row spacing. The greater yields and populations of the guard rows compared to the cane rows in the net plot area could only be attributed to utilisation of the extra resources available in the 10 ft. breaks. The increased compensation at closer row spacings was obviously related to the greater proportion of extra resources available in the 10 ft. breaks.

Conclusions

The plant crop results of this experiment confirm the general trend towards higher yields at closer row spacings wherever soil moisture is not a severe limiting factor. The average increase in yield of 2.28 T.C.A. per annum (4.5 per cent) for every foot decrease in row width also confirms previous results. It remains to be seen how the ratoon yields at Pongola will compare with previous results obtained in Natal. On the basis of this result a change in row spacing from 5 ft. to 3 ft. should give a benefit of approximately 4.5 T.C.A. per annum for a plant crop.

This increase is too small to encourage farmers to change from an established spacing for which their equipment and management are designed. Furthermore, narrower row spacing requires more seedcane for planting and means that there will be a greater length of row per acre to be cultivated by hand and more stalks to be cut at harvest. The cost of these operations may more than offset the value of the increase in yield.

The value of closer row spacing as a means of improving productivity cannot, however, be ignored. It is suggested that narrower row spacings can be employed successfully only in conjunction with such practices as supplementary irrigation, pre-emergent herbicide applications, shorter cutting cycles and mechanised planting, spraying, cultivation and harvesting operations. All these aspects of crop production need to be correctly integrated with local demands and environmental conditions.

Since ridge-planting is at present only likely to be adopted at relatively wide row spacings to suit existing mechanical harvesters, the lower yields of ridge compared with furrow planting at close row spacing have no immediate significance. The size of the ridges was, however, always excessive by comparison with requirements for efficient mechanical harvesting. In the event of mechanical harvesters being designed to suit closer row spacings, these results indicate that the ridges which are a necessary aid to cutting should be as low as possible to avoid lodging and consequent reduction in yield.

The loss in yield due to the existence of pipeline breaks in a 60 ft. x 60 ft. overhead irrigation system was found to be approximately 3 T.C.A. per annum for row spacings varying from 5 ft. 7 in. to 2 ft. 11 in. The results show that the degree of compensation by the guard rows adjacent to the laterals was greater at closer row spacings.

Summary

Results from a plant crop of sugarcane in a row spacing experiment conducted at Pongola have shown that there was a linear yield response to decreasing row spacing of 2.28 T.C.A. per annum (4.5 per cent) for every foot decrease in row width, over the range 7 ft. 2 in. to 2 ft. 11 in. This increased yield was associated with higher populations of thinner and lighter stalks. The comparison of furrow planting with ridge-planting showed that at row spacings wider than 3 ft. 10 in., yields were unaffected, whereas at closer row spacings, the ridge-planted cane gave significantly lower yields from higher populations of shorter, thinner and lighter stalks. This reduced yield was ascribed to the greater severity of lodging of ridge-planted cane at closer row spacings. The yield loss due to the 10 ft. pipeline breaks in a 60 ft. x 60 ft. overhead irrigation layout was approximately 3 T.C.A. per annum. The degree of compensation by rows adjacent to the irrigation laterals was considerably greater at close than at wide row spacings.

Acknowledgements

Thanks are due to Mr. M. G. Murdoch for his contribution to the design of the experiment, and also for the statistical analyses.

The results discussed in this paper are being used for post-graduate work in the Department of Crop Science at the University of Natal.

References

1. Cackett, K. E., 1964. A simple device for measuring canopy cover. Rhod. J. Agric. Res. 2: 56.
2. Thompson, G. D., 1962. Sugarcane plant populations. S. Afr. Sug. J. 46: 961-963.
3. Thompson, G. D. and Boyce, J. P., 1968. Plant crop results of two irrigation experiments at Pongola. Proc. S. Afr. Sug. Technol. Assoc., 42.
4. Thompson, G. D. and du Toit, J. L., 1965. The effects of row spacing on sugarcane crops in Natal. Proc. Int. Soc. Sug. Cane Technol. 12: 103-111.

Discussion

Mr. Main: I think it possible that the guard row variation has been influenced by temperature. It is noticeable in the Midlands that the row along the break is small, due to the effect of low temperature compared to elsewhere where the row along the break is tall.

When the experiment with close spacing is duplicated I think sucrose must be taken into account as I suspect sucrose might be lower owing to lack of sunlight.

Mr. Boyce: In contradiction to our results I also have seen outside rows lower than the inside rows but I think this is related to radiation in our case.

We did some sucrose analyses, see Table 2, and there is very little difference.

Mr. Turck: When cane is irrigated closer spacing is a great help although some difficulty may be experienced as the stools get larger.

Mr. Bartlett: Between the age of one month and six months a considerable amount of nutrient and moisture appears to be going into stalks which are going to die because of competition. May not the competition be eliminated by planting fewer stools more accurately spaced?

Seeing experiments have been done in spacing setts I would like to know what the population count drop off was as the cane aged. Spacing is important, especially from a mechanisation angle.

Mr. du Toit: I recently saw one of the experiments at Pongola where spacing is varied between rows and also between setts. The whole cane growth alters completely. However, to use the data properly for the present experiments also, the cane should be harvested at different times.

Mr. Boyce: The object of one of the experiments referred to by Mr. du Toit is to try and determine the number of stools, not number of stalks, that we require and we used two different varieties, N:Co.376 and C.B.36/14, and it may be possible to reduce the amount of tillering with certain chemicals or cultural practices.

Mr. Glover: The root laboratory experiments agreed with Mr. Boyce's that the close spaced plots lost virtually no sucrose provided they were irrigated.

Mr. Boyce: We have had no detrimental effects in our experiments anywhere in Natal as long as we have had normal fertilizer levels and row spacings not less than three feet.

Mr. Wilson: Mr. Boyce in his paper says that because of the extra planting material required for close spacing and the small increase in yield the cane farmer would not be interested. However, if planting material can be decreased by use of single eyed setts, for instance, so that only 800 pounds of planting material need be used per acre only a small increase in yield would still make it worthwhile.

Mr. Gosnell: What effect did row spacing have on lodging? What was the effect of ridge versus furrow?

In disagreement with Mr. Turck, I think wide spacing is more economic than close spacing when irrigation is used owing to the lesser amount of labour required.

Mr. Boyce: Planting in the furrow gave no differences in lodging at the different row spaces.

Planting on ridges gave extra lodging at closer spacing.

Mr. Turck: It is easier to get water on to the ridges if the rows are planted closer together. Labour is not affected because with a narrow ridge water will run down faster.

When alternate row irrigation is practised on flat land smaller rows are easier than bigger ones.

Mr. du Toit: In previous experiments narrow spacing did increase lodging. This experiment was carried out at Pongola, where wind is not a serious factor.

Dr. Thompson: In experiments here closer row spacing did lead to increased lodging. We came down to 1′ 6″ whereas Mr. Boyce stopped at 2′ 11″ so this again could cause a difference.

Mr. Wilson: The comparison was not valid because the close spaced cane was much taller than the wider spaced cane and therefore more liable to fall over at the same age.

Mr. Bartlett: These experiments could play a vital part in future mechanisation. Machines which are now being developed for harvesting cane might, with further development in the future, be able to handle more than two or three rows of cane.

The problem of cultivating narrow spaced ratoons could be solved by using herbicides.