

Effect of Drowning on Flowering and Seed Setting of Some Sugar Cane Varieties, at Alexandria, Egypt

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ABSTRACT

Fourteen Varieties of sugar cane were chosen from the field of breeding programme in Sabahia Research Station at Alexandria during 2002 to 2005 seasons to study the effect of drowning on the flowering and seed setting of these varieties. Each variety was planted in two ridges. The length of ridge was 5 meters and the distance between the ridges was 125 cm. The rate of nitrogen fertilization was 100 Kg. It was added in three doses. It was after 75, 90 and 120 days from planting date. The rate of doses was equal. Irrigation was every 15 days with the exception of July and August. It was drowned at height 35 cm. It were covered the first and second Internodes. Drainage was every 3 days, and drowning again in the fourth day. All the other cultural practices were conducted for every two ridges in the similar manner whenever possible. The results obtained were as follows:

1. The varieties were differed within and between for flowering dates, flowering percentage, seed setting, flowering duration and seedlings number.
2. The seed setting varieties were differed between, while some varieties were seed setting and another were not seed setting.
3. The seed setting were in the first ratoon only, while the plant crop and second ratoon the crossing were not succeeded.
4. The seedlings number which were obtained were varied from one variety to another. Also some varieties did not enable to obtain the seedlings like the prior varieties.

INTRODUCTION

The world sugar production was depending upon sugar cane in the tropical and subtropical regions and sugar beet in moderate and cold regions. The sugar production from sugar cane was about 73% from the world sugar production, while sugar beet production was about 27%.

In Egypt sugar cane was the only source of sugar up to 1982. The sugar production did not cover the sugar consumption. The gap between production and consumption was 950.000 tons in 2004 season. It is equal to 37.8% from total sugar production in 2004 season.

To cover this gap, programs were designed to improve the production of sugar cane and sugar beet through cultural practices and breeding programs.

Many investigators reported that flowering, seed setting and crossing varied from nil to 100 percent, according to the environmental and genetic factors e.g. variety, plant crop or ratooning, growth, vigour, cultural treatments, temperature, relative humidity, etc.(Rao *et al.* 1973, Nour *et al.* 1977, Gaber *et al.* 1981 a and b, Gaber *et al.* 1984 a, b and c, Gaber *et al.* 1990, Gaber *et al.* 1990 a and b, Gaber *et al.* 1992, Gaber and Rashwan, 1993, Abo El-Fatth *et al.* 1994, Abo El-Fatth and Gaber 2004, and Gaber and Abo El-Fatth 2004).

The present work was carried out to study the effect of drowning on the flowering dates, flowering percentage, flowering duration, and seed setting and seedling of some sugar cane varieties under the Egyptian conditions in Sabahia Research Station at Alexandria.

MATERIALS AND METHODS

Fourteen varieties of sugar cane were chosen from the field of breeding programme in Sabahia Research Station at Alexandria during 2002 to 2005 seasons to study the effect of drowning on the flowering dates, flowering percentage, flowering duration, seed setting and seedlings number of the certain varieties under the Egyptian conditions. These varieties were imported from various countries with wide latitude for flowering. 10 varieties from India, 3 varieties from USA and one variety from Dominican Republic.

Each variety was sown in two ridges. The length of ridge was 5.0 meters and the width was 1.25 m. Seed cuttings were sown by one and half row method.

Nitrogen was applied at the rate of 100 kg. per faddangiven as three doses, the first after 75 days from planting and contained one-third the quantity and the second one-third after 90 days from planting and the later after 120 days form planting and contained one-third the quantity.

Irrigation was carried out every 15 days with the exception of July and August was drowning up the first

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and second internodes (about 35 cm). Every three days drainage was conducted and the fourth day irrigation was carried out for leaching the nitrogen content.

All the other cultural practices were carried out for every two ridges in a similar manner whenever possible. The full flowering date, flowering percentage, flowering duration, seed setting and seedlings number was recorded in the former certain varieties.

The flowering percentage were calculated as the following equation:

$$\text{Flowering percentage} = \frac{\text{Number of plumps flowered}}{\text{Total number of plumps}} \times 100$$

The obtained seeds were sown in pots. Ten pots were planted from each variety. Each pot contained one

hundred seeds. The germinated seeds and seedling were counted.

The sown varieties were Co. 312, 508, 513, 527, 975, 1075 and 1148; Co.L. 54, 94 and 57 from India. While C.P. 31-289, 31-294 and 90-28 from USA. While Crystalina from Dominican Republic.

RESULTS AND DISCUSSION

Table 1 shows that the full flowering dates and the flowering percentage of the certain varieties in plant crop, first and second ratoon from 2002 to 2005 seasons.

It is clear that sugar cane varieties were differed in the flowering dates and flowering percentage from one variety to another and from season to season.

Table 1. Effect of drowning on the flowering dates and flowering percentages in Sabahia Research Station at Alexandria during 2002/2003, 2003/2004 and 2004/2005 seasons.

No	Variety	Full flowering dates an percentages					
		Plant crop 2002/2003	Flowering %	First ratoon 2003/2004	Flowering %	Second ratoon 2004/2005	Flowering %
1	Co. 312	30-1-2003	100.0	-	-	-	-
2	508	8-3-2003	100.0	21-6-2004	100.0	-	-
3	513	29-3-2003	75.5	25-2-2004	55.0	-	-
4	527	28-4-2003	66.8	-	-	25-3-2005	42.8
5	975	29-3-2003	95.0	-	-	30-5-2005	75.3
6	1075	8-3-2003	100.0	1-5-2004	100.0	25-3-2005	100.0
7	1148	17-5-2003	100.0	1-5-2004	100.0	30-1-2005	100.0
8	Co.L.54	25-1-2003	85.0	5-4-2004	65.5	-	-
9	83	28-12-2003	100.0	25-2-2004	100.0	10-2-2005	100.0
10	87	28-12-2003	45.7	25-2-2004	35.7	15-4-2005	55.7
11	C.P.31-289	-	-	25-2-2004	96.0	5-4-2005	87.0
12	31-294	-	-	12-5-2004	100.0	-	-
13	50-28	-	-	21-5-2004	10.8	-	-
14	Crystalina	4-5-2003	34.0	1-6-2004	14.6	-	-

Table 2 indicates that crossing, seed setting and seedlings number of 14 varieties of sugar cane in plant crop, first and second ratoon from 2002 to 2005 seasons.

It is clear that the crossing and seed setting were not succeeded with the exception of first ratoon. The number of seedlings was differed from one variety to another except 5 varieties.

Table 2. Effect of drowning on the crossing, seed setting and seedlings number in Sabahia Research Station at Alexandria during 2002/2003, 2003/2004 and 2004/2005 seasons.

No	Variety	Plant crop 2002/2003		First ratoon 2003/2004		Second ratoon 2004/2005				
		Crossing & seed setting	Seedling No.	Crossing & seed setting	Seedling No.	Crossing & seed setting	Seedling No.			
1	Co. 312 X?				-					
2	508 X?				1					
3	513 X?			Some varieties succeeded and others not succeeded	23					
4	527 X?				-					
5	975 X?				-					
6	1075 X?				-					
7	1148 X?	Not Succeeded	No Seedlings		-		Not Succeeded	No Seedlings		
8	Co.L.54 X?								7	
9	83 X?								164	
10	87 X?								7	
11	C.P.31-289 X?								74	
12	31-294 X?								2	
13	50-28 X?								7	
14	Crystalina X?								53	

Table 3 reveals that the monthly average of maximum and minimum temperature degrees, mean and range. Also, it is reported the monthly average of maximum and minimum of relative humidity, mean and range from January 2002 to December 2005 at Alexandria.

Regarding to Table 3 shows that the temperature degrees and relative humidity were differed form one month to another, one day to other and from one season to another. It is due to the variation of environmental conditions. Subsequently, it is referred to the prior varieties. Beside the genetic variations and the interaction between genotypes and climatic conditions.

Figure 1 clears the average of flowering percentages in the certain varieties. It was begun from 10.8 to 100.0 percent. The flowering percentages were differed from one variety to another. It was divided to four groups as follows:

1. Very high flowering percentage: It was 100%. It contains six varieties, were Co. 312, Co. 508, Co. 1075, Co. 1148, Co.L. 83 and C.P. 31-294.
2. High flowering percentages: It was between 75.2 to 91.5%. It contains 3 varieties, were Co.L. 54, Co. 975 and C.P. 31-289.
3. Middle flowering percentages: It was between 45.7 to 65.2%. It contains 3 varieties, were Co.L. 87, Co.527 and Co. 513.

Table 3. Temperature degrees and relative humidity from 202 to 2005 seasons at Sabahia Research Station at Alexandria, Egypt.

No.	Month	Temperature degrees				Relative humidity			
		Average of		Mean	Range	Average of		Mean	Range
		Max.	Min.			Max.	Min.		
1	January2002	17.4	7.3	12.4	10.1	98.0	68.0	83.0	30.0
2	February	19.6	8.4	14.0	11.2	99.0	70.0	84.0	29.0
3	March	22.8	10.1	16.5	12.7	98.0	57.0	77.0	41.0
4	April	27.2	12.7	19.5	14.5	99.0	52.0	76.0	47.0
5	May	29.3	17.1	22.5	12.2	98.0	50.0	75.0	48.0
6	June	37.1	21.3	29.2	15.8	72.0	22.0	47.0	50.0
7	July	34.5	23.1	28.8	11.4	97.0	58.0	77.0	39.0
8	August	33.6	23.4	28.5	10.2	97.0	62.0	79.0	35.0
9	September	34.0	21.0	27.0	13.0	96.0	50.0	73.0	46.0
10	October	29.3	18.2	23.8	11.1	97.0	61.0	79.0	36.0
11	November	26.2	12.8	19.5	13.4	96.0	62.0	79.0	34.0
12	December	21.0	10.1	15.6	10.9	93.0	58.0	76.0	35.0
13	January2003	21.5	9.8	15.6	11.7	96.0	55.0	76.0	41.0
14	February	23.8	12.2	18.3	11.6	99.0	72.0	75.0	27.0
15	March	20.1	9.3	14.7	10.8	97.0	57.0	77.0	40.0
16	April	25.8	13.2	19.5	12.6	96.0	46.0	71.0	50.0
17	May	30.1	16.8	23.5	13.3	98.0	56.0	77.0	42.0
18	June	31.9	19.2	25.6	12.7	100.0	58.0	79.0	42.0
19	July	32.8	23.3	28.0	19.5	96.0	62.0	79.0	34.0
20	August	40.3	22.8	31.6	17.5	98.6	66.2	42.2	32.4
21	September	32.3	20.3	26.3	12.0	96.0	56.0	76.0	40.0
22	October	31.7	18.1	24.9	13.6	100.0	50.0	75.0	50.0
23	November	23.7	12.0	17.9	11.7	100.0	82.0	91.0	18.0
24	December	21.2	10.6	15.9	10.6	98.0	61.0	79.0	37.0

Continued

Table 3. (Continued)

No.	Month	Temperature degrees				Relative humidity			
		Average of		Mean	Range	Average of		Mean	Range
		Max.	Min.			Max.	Min.		
25	January2004	17.9	7.8	13.3	10.1	98.0	66.0	82.0	32.0
26	February	24.9	13.4	19.2	11.5	100.0	73.0	87.0	27.0
27	March	23.9	11.2	17.3	12.7	99.0	58.0	78.0	41.0
28	April	26.0	12.0	19.2	14.0	99.0	51.0	75.0	28.0
29	May	28.1	16.5	22.3	11.6	98.0	50.0	74.0	48.0
30	June	30.1	19.4	24.8	10.7	99.0	62.0	81.0	37.0
31	July	33.0	22.1	27.6	10.9	99.0	61.0	80.0	38.0
32	August	33.3	22.0	27.7	11.3	99.0	64.0	81.0	35.0
33	September	31.5	19.6	25.6	11.9	99.0	58.0	78.0	41.0
34	October	31.4	17.3	24.3	14.1	89.0	37.0	63.0	52.0
35	November	26.0	15.2	20.6	10.8	99.0	62.0	80.0	37.0
36	December	20.1	10.5	15.8	9.6	98.0	60.0	78.0	38.0
37	January2005	16.7	6.6	12.3	10.1	99.0	69.0	82.0	30.0
38	February	19.6	8.9	14.3	10.7	98.0	67.0	82.0	31.0
39	March	21.8	12.2	17.1	9.6	95.0	57.0	76.0	38.0
40	April	23.7	13.3	18.5	10.4	99.0	56.0	77.0	43.0
41	May	28.5	15.9	22.2	12.6	99.0	57.0	78.0	42.0
42	June	30.1	19.5	24.8	10.6	99.0	64.0	82.0	35.0
43	July	32.3	21.5	26.9	10.8	100.0	64.0	82.0	36.0
44	August	32.8	23.1	28.0	9.7	89.0	58.0	73.0	31.0
45	September	33.1	20.7	26.7	12.4	97.0	57.0	77.0	40.0
46	October	27.7	17.4	22.5	10.3	96.0	61.0	78.0	35.0
47	November	24.0	13.3	18.6	10.7	97.0	59.0	78.0	38.0
48	December	20.0	10.0	17.9	10.0	97.8	60.0	78.8	37.8

— Monthly Agricultural Meteorology from 2002 to 2005 seasons, Agricultural Research Centre, Giza, Cairo, Egypt.

4. Lower flowering percentages: It was between 10.8 to 24.3. It contains 2 varieties, were C.P. 50-28 and Crystalina.

Figure 2 shows that the average of flowering duration of the mentioned varieties of sugar cane. It was started from December to June during 2002 to 2005 seasons. It was differed from one variety to another. It was divided to four groups as follow:

1. Very short duration: It was between 7 to 14 days. It contained 3 varieties, were Co. 312, C.P. 31-294 and C.P. 50-28.
2. Short duration: It was between 27 to 40 days. It contains 4 varieties, were as Co. 513, Co. 527, C.P. 31-289 and Crystalina.

3. Middle duration: It was between 53 to 70 days. It contains 4 varieties, were Co. 975, Co. 1075, Co.L. 54 and Co.L. 83.

4. Long duration: It was between 103 to 107 days. It contains 3 varieties, were Co. 508, Co. 1148 and Co.L. 87.

Figure 3 cleared that the effect of drowning on the seedlings number in the first ratoon of the preceding varieties of sugar cane. It was differed from one variety to another. It was divided to four groups as follows:

1. Low seedlings number: It was between 1 to 7 seedlings. It contains 5 varieties, were Co. 508, Co.L. 54, Co.L. 87, C.P. 31-294 and C.P. 50-28.
2. Middle seedlings number: It was between 20 to 50 seedlings. It contains one variety. It was Co. 513.

3. High seedlings number: It was between 41 to 100 seedlings. It contains two varieties, were Crystalina and C.P. 31-289.

4. Very high seedlings number: It was over 100 seedlings. It contains one variety. It was Co.L. 83.

The above results seems to add more support to the finding of Humbert (1968) who found that sugar cane has remarkable thirst for water during the vegetative growth in order to physiological maturing in induce flowering. It is a crop with relatively high consumptive use efficiency. It is still grown in Egypt because the irrigation and drainage projects developed through the previous centuries.

Also, Humbert (1968) reported that the timing of irrigation rounds depends on the water needs of the cane plant, which vary depending on the season, the availability of water and storage capacity of soils in which the cane's root system is active. He added that the prior studies in Hawaii and Mexico indicate that daily water requirements of sugar cane vary from 0.35 inches per day in hot, dry summer months to 0.10 inches per day in the cold, cloudily winter months.

In this connection Alexander (1973) stated that water management in the sugar cane is the best factor for flower prevention, acceleration and delaying.

Also, Humbert (1968) and Alexander (1973) indicate that flowering of sugar cane are the highest where adequate attention has been given to the water requirements. Many authors agree that controlled water supply during the critical period of flower induction is the most effective means of flower control available to cane grower (Humbert 1968).

In Egypt, before the high dam the flooding method in water being forced to spread over vast areas was used during the season of high stream flow. But, after the high dam, the various systems of surface irrigation and other methods were used.

Variations in weather are cause of considerable variability in growth rates, sugar storage, flowering and tillering incidence (Tables 1 and 3 Figures 1 and 3).

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and tillering incidence (Tables 1 and 3 Figures 1 and 3).

In this aspect it could be referred to Humbert (1968), Gaber *et al.* (1984c), Gaber and Rashwan (1990), Gaber *et al.* (1992), El-Manhaly *et al.* (1981) and (1987) who found that sugar cane flowering vary tremendously due to many factors as follow:

- (1) Variable soil fertility.
- (2) Varieties used.
- (3) Cultural practices.
- (4) Use of fertilizers.
- (5) Irrigation.
- (6) Control of weeds.
- (7) Pests and Diseases.
- (8) And other factors.

In Egypt, the sugar cane flowering is considered to be new direction in cane breeding programme. The above mentioned data agree with those reported by Brett (1950) and Climents (1964) who reported that the optimum conditions for floral initiation and tasselling in sugar cane.

It was concluded from Rao *et al.* (1968) that the conditions of temperature, humidity and day length in Alexandria, Egypt is ideal for floral induction (Rao *et al.*, 1973).

In Egypt, the trials of sugar cane flowering were succeeded with controlling of irrigations regime and nitrogen fertilization at Alexandria (Rao *et al.*, 1973, Nour *et al.*, 1977 and Allam *et al.*, 1977).

The varieties of sugar cane differ widely in the physiological characters, especially the occurrence of flowering under Egyptian conditions (Gaber *et al.*, 1981a).

The end product of this study, to maximize the crossing period we must to select the sugar cane varieties which flowering duration is long as Co. 508, Co. 1148 and Co.L. 87, and seedlings number were high or very high as Co.L. 83 and C.P. 31-289.

At Alexandria the heavy raining were during December and January. It is a difficult to work the sugar can crossing. Beside the temperature degrees is very low (Table 3). The adequate temperature degrees for crossing is between 18 to 32°C (Gaber *et al.*, 1984c). We must to choose the days or the periods, which the temperature degrees were between 18 to 32°C.

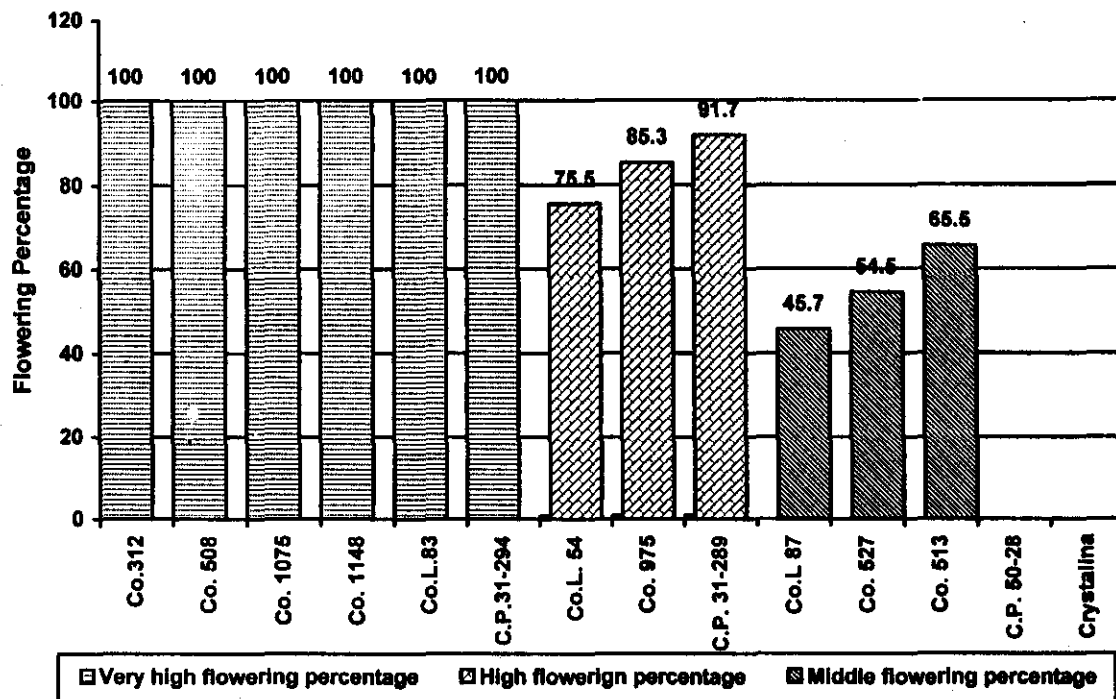


Figure 1: Effect of drowning on the average flowering percentage of some sugar cane varieties in Sabahia Res. St. At Alex. From 2002 to 2005 seasons.

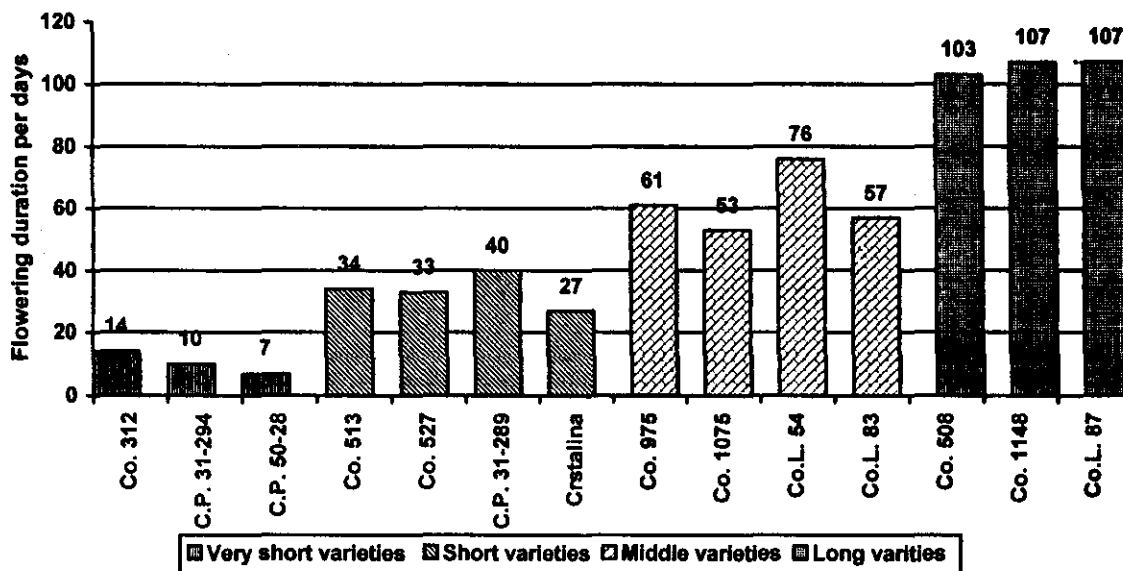


Figure 2: Effect of drowning on the average flowering duration of some sugar cane varieties in Sabahia Res. St. at Alex. From 2002 to 2005 seasons.

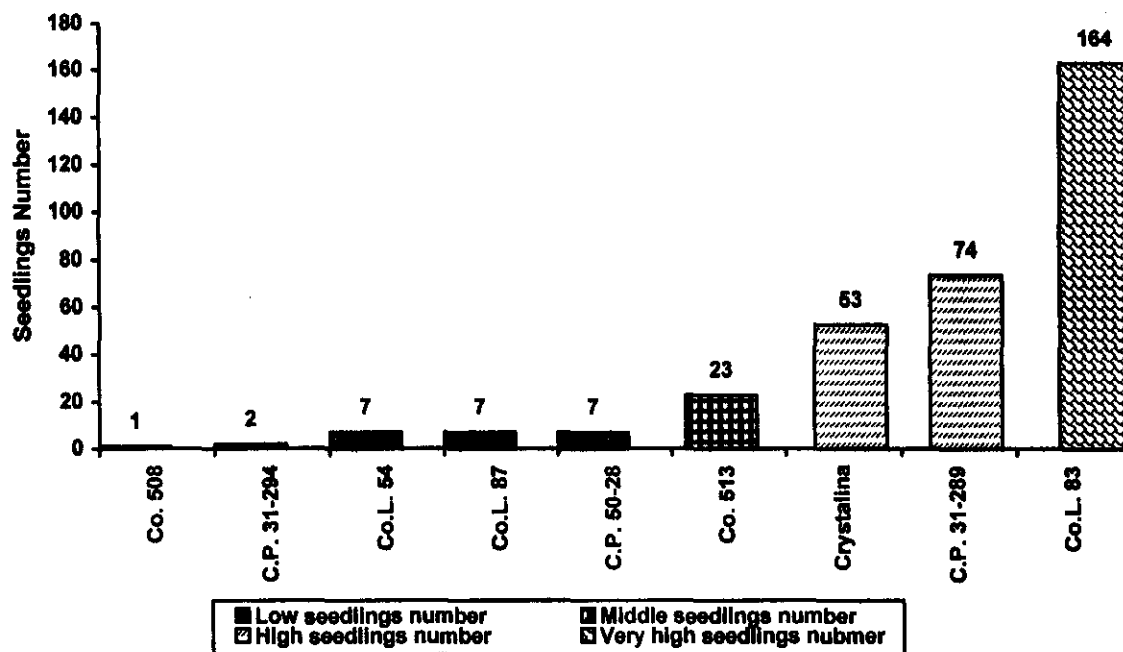


Figure 3: Effect of drowning on the seedlings of some sugar cane varieties from plant crop, first and second ratoon during 2002/2003, 2003/2004 and 2004/2005 seasons.

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الملخص العربي

تأثير الغرق على أزهار وعقد البذور لبعض أصناف قصب السكر

للغرس والخلفة الأولى والخلفة الثانية

عبد الحميد عبد الحميد حابر - صفاء سالم محمد السيد - محمد فوزى أبو الفتح

- تم اختبار ١٤ صنفاً من أصناف قصب السكر من حقل التربية محطة البحوث الزراعية بالصباحية خلال المدة من ٢٠٠٢ حتى ٢٠٠٥ وذلك لدراسة تأثير الغرق على إزهار وعقد البذور وعدد البادرات لهذه الأصناف - كل صنف تم زراعته في خطين طول الخط ٥٥ والمسافة ما بين كل خط وآخر ١٢٥ سم ولقد تم التسميد بمعدل ١٠٠ كجم على ثلاث دفعات الأولى بعد ٧٥ يوماً من الزراعة والثانية بعد ٩٠ يوماً والثالثة بعد ١٢٠ يوماً من الزراعة بمعدلات متساوية وكان الري كل ١٥ يوماً ما عدا يوليو وأغسطس فتم غمر الأرض لمسافة ٣٥ سم أى تم تغطية العقلة الأولى والثانية وكانت المياه تصرف كل ٣ يوم ويتم إعادة الغمر في اليوم الرابع وتم إجراء باقى العمليات الزراعية كما هو متبع بالمنطقة التى زرعت بها هذه الأصناف وتم الحصول على النتائج التالية:
- ١- اختلفت الأصناف فيما بينها من حيث تاريخ ونسبة التزهير.
 - ٢- الأصناف التى أزهرت اختلفت فيما بينها من حيث عقد البذور فقد تم العقد فى بعض الأصناف ولم يتم العقد فى البعض الآخر.
 - ٣- اختلفت الأصناف فيما بينها من حيث مدة الإزهار.
 - ٤- اختلفت الأصناف فيما بينها من حيث الغرس والخلفة الأولى والثانية.
 - ٥- لم يتم عقد للبذور والحصول على بادرات إلا فى الخلفة الأولى فقط.