4- RESULTS AND DISCUSSION

4-I. Growth :

4-I.1. Pseudostem height :

Table (1) and **Fig. (1)** show pseudostem height of different banana cultivars at bunch shooting in both seasons of study. Pseudostem height significantly varied from 177.95 cm. for Hindi to 489.70 cm. for Mohamed Ali in the first season and from 183.75 cm. to 506.65 cm. for the same two cultivars , respectively in the second season. Other studied cultivars were in between. The average of both 1985/86 and 1986/87 seasons gave the same trend as each of the two seasons. Furthermore , data indicated that different cultivars under study could be arranged under three height groups : The first was < 250 cm. which include Dwarf Cavendish cultivars i.e. Hindi and Basrai (Shortest cultivars). The second group had a range 251 - 400 cm. for Williams , Poyo , and Maghrabi cultivars in ascending order. These cultivars could be considered as Giant Cavendish cultivars. The third group had pseudostems taller than 400 cm. and were considered as Sapientum cultivars (tallest cultivars). These cultivars were Sindihi , Ambel , Paradica , and Mohamed Ali in ascending order. Therefore , it is easy to conclude that Hindi was the shortest whilist Mohamed Ali was the tallest cultivars under study.

Table (1) : Pseudostem height, circumference and height/circumference ratio at bunch shooting of different banana cultivars (1985 / 1986, and 1986 / 1987 seasons).

Cultivar	Pseudostem								
	Height (cm)			Circumference (cm)			Height / Circumference ratio		
	85/86	86/87	Average	85/86	86/87	Average	85/86	86/87	Average
Hindi	177.95 a	183.75 a	180.85 a	74.25 a	75.25 a	74.75 a	2.40 b	2.44 a	2.42 b
Basrai	191.45 a	202.50 b	196.98 b	83.85 b	82.55 abc	83.20 c	2.28 a	2.45 a	2.37 a
Williams	279.00 b	307.75 c	293.38 c	88.95 c	89.45 cde	89.20 d	3.14 c	3.44 b	3.29 c
Poyo	345.20 c	350.75 d	347.98 d	90.25 c	86.35 bcd	88.30 d	3.82 e	4.06 d	3.94 e
Maghrabi	347.40 c	353.00 d	350.20 d	93.85 d	94.35 def	94.10 e	3.70 d	3.74 c	3.72 d
Paradica	483.05 e	486.20 j	484.63 j	107.90 f	106.70 j	107.30 h	4.48 j	4.56 f	4.52 j
Ambel	469.65 de	468.90 f	469.28 f	79.85 b	78.40 ab	79.13 b	5.88 i	5.98 h	5.93 i
Mohamed Ali	489.70 e	506.65 h	498.18 h	98.65 e	97.45 f	98.05 f	4.96 h	5.20 j	5.08 h
Sindihi	442.75 d	444.65 e	443.70 e	102.45 e	103.25 fj	102.85 j	4.32 f	4.31 e	4.31 f

Means followed by same letter (s), within each column, are not significantly different from each other at 5 % level.

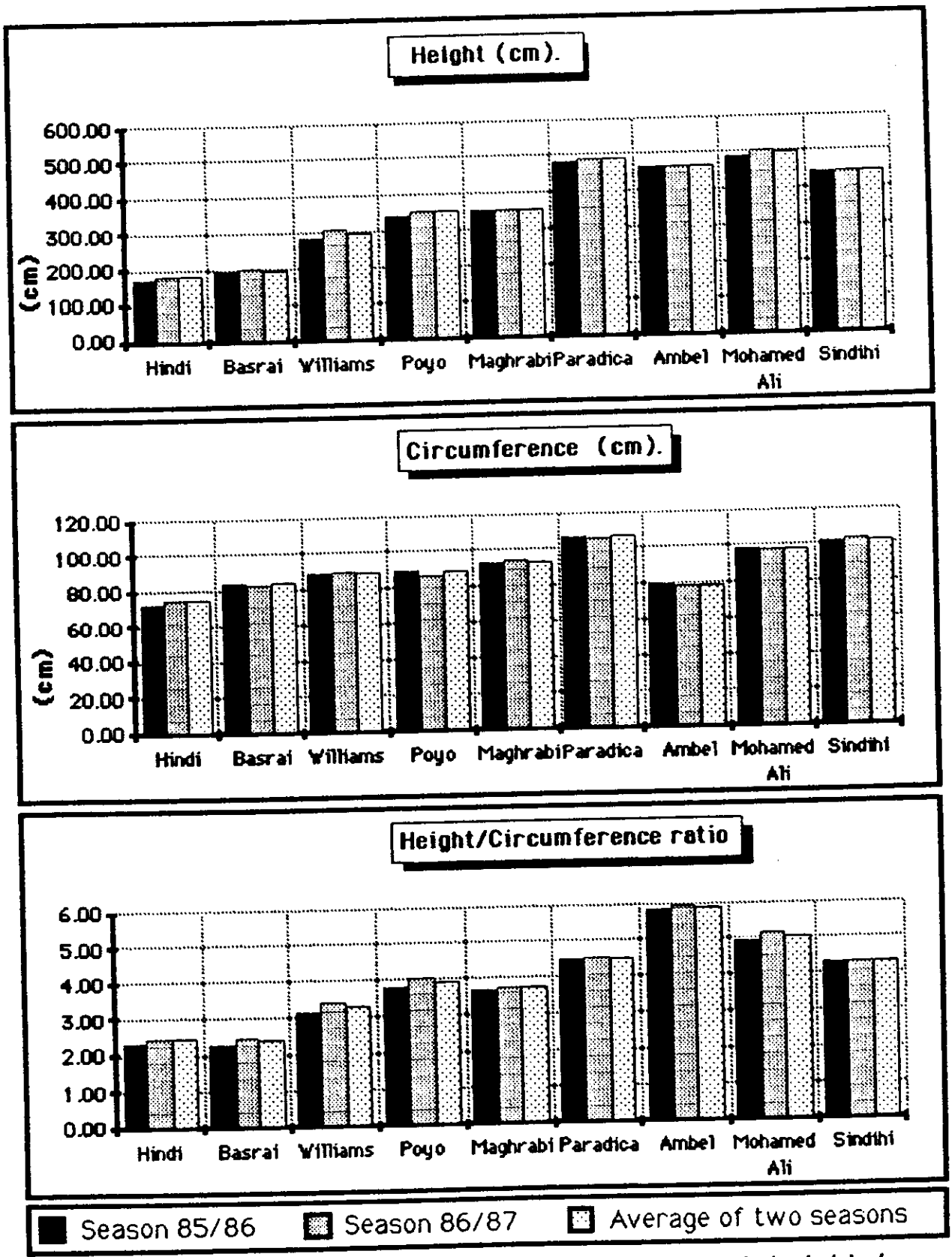

Fig. (1): Pseudostem height, circumference and height / circumference ratio at bunch shooting of different banana cultivars (seasons, 1985/1986 and 1986/1987).

In regard to statistical analysis , it is well noticed that significant difference between pseudostem height of both Poyo and Maghrabi cultivars was lacking . However , differences between other cultivars studied were so high to reach the significant level .

The varietal differences in the pseudostem height of banana plants at bunch shooting for different banana cultivars are similar to the findings obtained by **Champion (1963) , Venkatesam et al (1965) , Behairy (1968) , Youssef (1968) , Walker (1970) , Malike and Ahmed (1972) , Swidan (1972) , Lassoudiere (1974) , Alagiamanvalan (1975) , El-Khorieby (1980) , Holder and Gumbs (1983 - a) , Azhakiamanavalan et al (1984) , Israeli (1985) , Abou-Aziz et al (1987 a&b) , Mayaz (1987) , and Tadros et al (1987).**

4-I.2. Pseudostem circumference :

Pseudostem circumference as shown in **Table (1)** and illustrated in **Fig. (1)** significantly varied from 74.25 cm. for Hindi to 107.90 cm. for Paradica in the first season and from 75.25 cm. to 106.70 cm. for the same two cultivars , respectively in the second season . Other studied cultivars were in between. The average of two seasons gave the same trend as of each season separately. Moreover , data showed that different cultivars studied could be divided into three groups : The first group had pseudostems circumference of less than 86 cm. as in Hindi , Ambel and Basrai cultivars. The second one ranged from 87 to 96 cm. as for Poyo ,

Williams and Maghrabi cultivars in ascending order. The third group exceeded 96 cm. as for Mohamed Ali , Sindihi , and Paradica cultivars.

Concerning statistical analysis , it is quite evident that significant difference between Williams and Poyo cultivars was abscent . On the other hand , differences between other cultivars were significant .

Many previous findings are in agreement with the present results such as **Venkatesam et al (1965) , Youssef (1968) , Malike and Ahmed (1972) , Swidan (1972) , Lassoudiere (1974) , Abd El-Kader (1979) , El-Khoreiby (1980) , Holder and Gumbs (1983-a) , Robinson and Nel (1985) , Abou-Aziz et al (1987 - a) , Mayaz (1987) and Tadros et al (1987).**

4-I.3. Height / Circumference ratio :

Table (1) and **Fig. (1)** show that height/ circumference ratio of pseudostem at bunch shooting for different banana cultivars , significantly differed from 2.29 for Basrai to 5.88 for Ambel in the first season and from 2.44 for Hindi to 5.99 for Ambel in the second one. Other studied cultivars were in between. The average of two seasons showed the same trend as of each season alone. In addition , data also indicated that different cultivars studied could be placed under three groups . The first one had a ratio that is less than 3.55 which covered Basrai , Hindi , and Williams cultivars. The second varied from 3.56 to 4.74 for Poyo , Maghrabi , Sindihi , and Paradica cultivars in ascending order. The third exceeded the ratio of 4.75 that involved Mohamed Ali and Ambel cultivars.

The significant differences between the cultivars were clearly noticed.

These findings confirm the results obtained by **Behairy (1968) , Ahmed et al (1974) and Robinson and Nel (1985).**

4-I.4. Total number of leaves per plant :

Total number of leaves per plant as presented in **Table (2)** and graphically demonstrated in **Fig. (2)** significantly varied from 38.95 for Ambel to 45.50 leaves for Hindi in the first season and from 36.50 for Mohamed Ali to 45.60 for Hindi in the second one. Meanwhile , the average of the two seasons behaved the same as the trend of each season separately , as well as , it indicated that different cultivars under study could be divided into three classes in this respect. The first class with a total number of leaves/plant less than 40.0 which included Mohamed Ali , Sindihi , Ambel , Paradica , Maghrabi , and Poyo cultivars. The second class varied from 40.1 to 43.0 leaves for Williams and Poyo cultivars in descending order. The third class had > 43 leaves/plant as for both Basrai and Hindi cultivars. Nevertheless , differences between most of the studied cultivars were free from significance.

These results are in agreement with that reported by **Baghdadi and Keleg (1966) , Malik and Ahmed (1972) , Turner (1972) , Abd El-Kader (1979) , Stover (1979) , El-Khoreiby (1980) , Kuhne (1980) , Robinson (1981) , Holder and Gumbs (1983-a) , Israeli (1985) and Robinson and Nel (1985).**

Table (2) : Total number of leaves, number of green leaves and total number of suckers per plant at bunch shooting of different banana cultivars (1985/1986. and 1986/1987 seasons).

Cultivar	Total number of leaves			Number of green leaves			Total number of suckers		
	85/86	86/87	Average	85/86	86/87	Average	85/86	86/87	Average
Hindi	45.50 e	45.60 d	45.55 d	11.85 b	11.75 ab	11.80 cd	2.70 a	2.50 a	2.60 a
Basrai	44.40 d	44.60 cd	44.50 cd	11.00 a	12.43 b	11.72 bcd	3.00 ab	3.06 ab	3.03 b
Williams	42.10 c	41.30 bc	41.70 bc	11.90 b	12.45 b	12.18 d	3.45 b	4.13 c	3.79 c
Poyo	40.15 b	40.10 ab	40.13 ab	11.50 b	11.90 ab	11.70 bc	3.45 b	3.63 bc	3.54 c
Maghrabi	40.05 b	39.40 ab	39.73 ab	11.00 a	10.80 a	10.90 a	3.40 b	3.63 bc	3.52 c
Paradica	39.05 a	37.80 ab	38.43 a	13.10 c	12.65 b	12.88 e	5.55 de	5.63 e	5.59 e
Ambel	38.95 a	37.30 ab	38.13 a	11.00 a	11.60 ab	11.30 ab	4.95 c	4.88 d	4.92 d
Mohamed Ali	39.05 a	36.50 a	37.78 a	12.70 c	12.60 b	12.65 e	5.25 cd	5.19 de	5.22 d
Sindihi	39.55 ab	36.60 a	38.08 a	12.75 c	12.55 b	12.65 e	5.85 e	5.81 e	5.83 f

Means followed by same letter (s), within each column, are not significantly different from each other at 5 % level

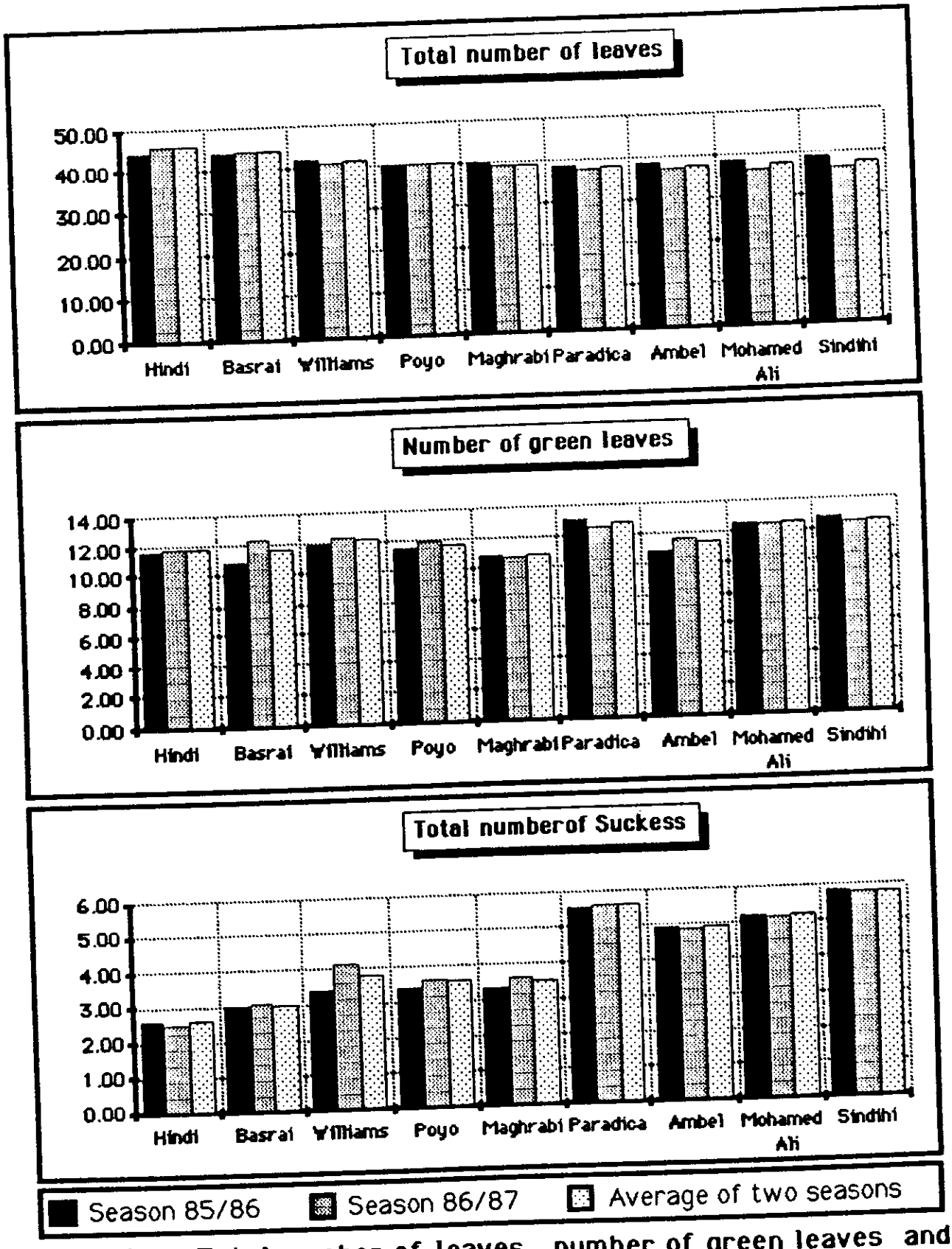

Fig. (2) : Total number of leaves , number of green leaves and total number of suckers per plant at bunch shooting of different banana cultivars (1985/1986. and 1986/1987 seasons).

4-1.5. Number of green leaves per plant :

It is clear from **Table (2)** and **Fig. (2)** that number of green leaves differed from one cultivar to other . In the first season , the lowest cultivars in number of green leaves (11.0) were Basrai , Maghrabi and Ambel whilist Paradica cultivar (13.1) gave the highest value in this respect. In the second season , Maghrabi was the lowest cultivar (10.80) in number of green leaves while , Paradica was the highest (12.65) in this concern. However , data of average of two seasons indicated the same trend of the second season. Anyhow , the studied cultivars could be arranged in relation to number of green leaves in three groups ; The first one had < 11.49 as for Maghrabi and Ambel cultivars. The second one differed from 11.5 to 11.9 leaves which resembled Poyo , Basrai , and Hindi cultivars. Finally , the third group had > 12 functional green leaves. Williams , Mohamed Ali , Sindihi and Paradica cultivars lied under this range.

Referring to the statistical analysis , data showed that the difference between Paradica and Maghrabi cultivars was so high to be significant. Moreover , no significant differences were noticed between Mohamed Ali , Sindihi and Paradica cultivars. On the other hand , Ambel , Poyo , and Basrai cultivars were statistically similar in their values . Beside , no difference was obtained , from the statistical point of view , between Williams , Basrai , and Hindi cultivars.

These results are in conjunction with those reported by **El-Khoreiby (1980) , Holder and Gumbs (1983- a) , Robinson and Nel (1985) . Abou-Aziz et al (1987- a and b) . Mayaz (1987) and Tadros et al (1987).**

4-I.6. Total number of suckers :

As far as total number of suckers was concerned , data presented in **Table (2)** and **Fig. (2)** showed that banana cultivars varied in their values in this respect. In both seasons , Sindihi cultivar produced the highest number of suckers while Hindi gave the opposite trend. Other studied cultivars were in between. In the meantime , data of the average of two seasons were in line with results of each season separately.

Moreover , banana cultivars under study appeared to be arranged in two categories in relation to the total number of suckers. The first category gave less than 4.5 suckers and included Hindi , Basrai , Poyo , Maghrabi and Williams cultivars. The second category gave more than 4.5 suckers as for Ambel , Mohamed Ali , Sindihi and Paradica cultivars.

In respect to the statistical analysis , data clearly indicated that no significant differences were noticed between Williams , Poyo , and Maghrabi cultivars. The same result was obtained when Ambel , and Mohamed Ali cultivars were put in account . In contrast , differences between the other cultivars under study were statistically significant.

These results are similar to those concluded by **Turner (1972) . Pillai (1978) . Abd El-Kader (1979 and 1986) . Saad (1979) and Abd El- Naby (1988).**

4-I.7. Fresh weight :

4-I.7.1. Whole plant :

A glance to **Table (3)** and **Fig. (3)** data clearly indicate that Paradica cultivar was the heaviest in fresh weight of whole plant among the studied cultivars whilist Hindi cultivar took the reverse trend in this respect. That was true in each season as well as an average for the two seasons. Moreover , banana cultivars under study appeared to fall in three different classes. The first class had a fresh weight that was less than 70 Kg. as for Hindi , Basrai , and Williams cultivars. The second class varied from 70 to 110 Kg. including Poyo , Maghrabi , and Mohamed Ali cultivars. The third group with fresh weight heavier > 110 Kg. as for Paradica , Ambel , and Sindihi cultivars.

Concerning differences between banana cultivars in this sphere, data of average of two seasons showed that significancy was present between different cultivars . However , values of both Poyo , and Maghrabi cultivars were statistically more or less similar.

The same trend was found by **Swidan (1972) , Twyford and Walmsley (1973), El-Khoreiby (1980) and Attia (1986).**

4-I.7.2. Leaves :

Considering fresh weight of leaves , it is quite evident from **Table (3)** and **Fig. (3)** that banana cultivars varied in this respect. However , no significant difference was noticed between Ambel , Mohamed Ali , and Sindihi cultivars. The same trend was observed

Table (3) : Fresh weightsof : whole plant , leaves , pseudostem and corm at bunch shooting of different banana cultivers (1985/1986 and 1986/1987 seasons).

Cultivar	Whole plant (Kg. / plant)			Leaves (Kg.)			Pseudostem (Kg.)			Corm (Kg.)		
	85/86	86/87	Average	85/86	86/87	Average	85/86	86/87	Average	85/86	86/87	Average
Hindi	44.30 a	44.10 a	44.20 a	5.60 a	5.80 a	5.70 a	32.30 a	31.70 a	32.00 a	6.40 a	6.60 a	6.50 a
Basrai	52.20 b	51.40 b	51.80 b	6.60 ab	6.60 b	6.60 ab	36.30 a	35.50 b	35.90 b	9.30 b	9.30 b	9.30 b
Williams	64.50 c	64.90 c	64.70 c	9.00 cd	9.00 e	9.00 d	43.00 b	43.40 c	43.20 c	12.50 c	12.50 c	12.50 c
Poyo	81.80 d	80.40 d	81.10 d	10.00 d	10.00 f	10.00 e	55.50 c	54.30 d	54.90 d	16.30 d	16.10 d	16.20 d
Maghrabi	83.10 d	83.10 d	83.10 d	12.50 e	12.70 j	12.60 f	55.00 c	54.40 d	54.70 d	15.60 d	16.00 d	15.80 d
Paradica	140.50 h	141.10 j	140.80 j	13.70 e	14.10 h	13.90 j	101.50 f	101.90 j	101.70 h	25.30 f	25.10 j	25.20 h
Ambel	124.70 j	124.50 f	124.60 f	6.80 ab	7.40 c	7.10 bc	98.20 ef	97.40 f	97.80 j	19.70 e	19.70 f	19.70 j
Mohamed Ali	97.00 e	98.20 e	97.60 e	7.50 bc	8.10 d	7.80 c	72.70 d	72.50 e	72.60 e	16.80 d	17.60 e	17.20 e
Sindihi	118.70 f	122.30 f	120.50 f	6.80 ab	7.40 c	7.10 bc	93.20 e	95.60 f	94.40 f	18.70 e	19.30 f	19.00 f

Means followed by same letter (s), within each column, are not significantly different from each other at 5 % level.

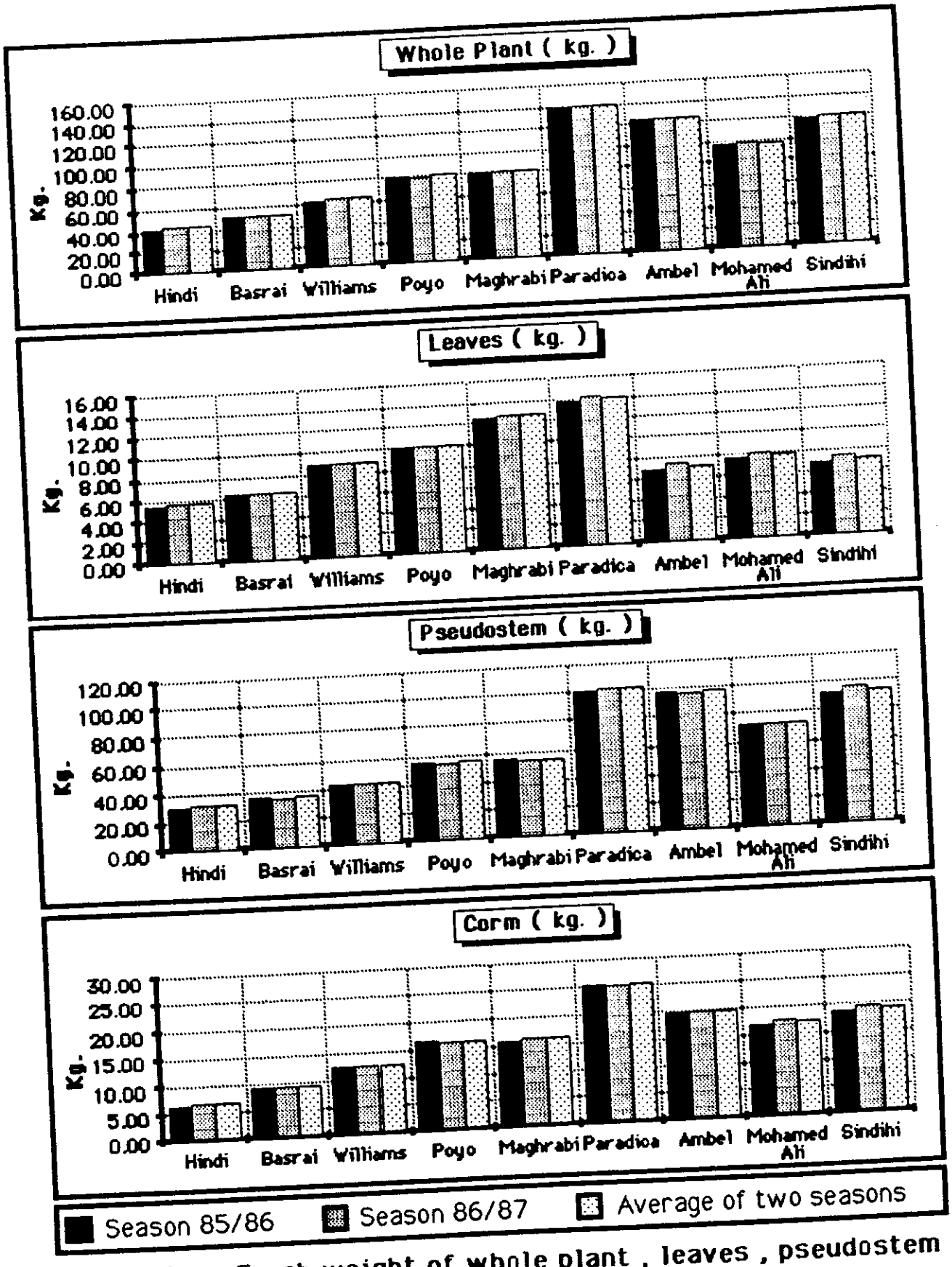

Fig. (3): Fresh weight of whole plant , leaves , pseudostem and corm at bunch shooting of different banana cultivars (1985/1986 and 1986/1987 seasons).

between Hindi and Basrai cultivars. By all means , Williams , Poyo and Maghrabi cultivars were statistically significant as compared to other cultivars under study.

At all events , Hindi cultivar was the lowest one in fresh weight of leaves , whilist Paradica cultivar surpassed all other cultivars in this concern. Other cultivars were in between.

Furthermore , values of banana cultivars as average of two seasons , could be arranged in three classes. The first class included Hindi , Basrai , Ambel , Mohamed Ali , and Sindihi with average leaves weight of < 8.5 Kg. The second group ranged from 8.6 to 11.0 Kg. as for Williams and Poyo cultivars. The third category involved Maghrabi and Paradica cultivars with an average leaves weight of > 11.1 kg.

The varietal differences which were evident in this study are similar to those mentioned by **Swidan (1972) and El-Khoreiby (1980).**

4-1.7.3. Pseudostem :

It is well noticed from **Table (3)** and **Fig. (3)** that banana cultivars varied visually in their values. Nevertheless , significant differences were less in the first season than in the second one. Thus , average of two seasons was put in consideration. It is clear that Hindi cultivar was the lowest one in its value while Paradica was the highest. Moreover , significant differences were evident between most of cultivars. However , differences between Poyo and Maghrabi cultivars were so small to reach the significant level. Furthermore , banana cultivars indicated three levels in pseudostem

fresh weight. The first level had a pseudostem of < 50 Kg. fresh weight as for Hindi , Basrai and Williams cultivars. The second one ranged from 51 to 75 Kg. as Poyo , Maghrabi , and Mohamed Ali cultivars. The third level with a pseudostem of > 76 Kg. fresh weight. This category covered Sindihi , Ambel , and Paradica cultivars.

These results were in agreement with that concluded by **Swidan (1972) and El-Khoreiby (1980).**

4-I.7.4. Corm :

Regarding corm fresh weight , it is obvious from **Table (3)** and **Fig. (3)** that in both seasons as well as the average of two seasons , banana cultivars varied significantly in their corm fresh weight. Thus , Hindi banana plants had corms with the lowest weight , while Paradica cultivar took the other way around in this sphere. Moreover , no significant difference was observed between Poyo and Maghrabi cultivars. In contrast , significancy was noticed between other cultivars.

Furthermore , values of different cultivars under study indicated three obvious levels of corm fresh weight. The first one with corms less than 12.7 Kg. as for Hindi , Basrai , and Williams cultivars. On the other hand , the second one with a range of 12.7 to 18.6 Kg. for Poyo , Maghrabi and Mohamed Ali cultivars. The third level with corms of more than 18.6 kg which covered Sindihi , Ambel, and paradica cultivars.

These results are similar to those obtained by **Swidan (1972) and EL-Khoreiby (1980).**

4-I.8. Leaf dimensions :

4-I.8.1. Leaf blade length :

Leaf blade length of banana cultivars is presented in **Table (4)** and graphically illustrated in **Fig. (4)**. It is clear that banana cultivars varied in this respect. The highest value was noticed for Mohamed Ali cultivar which had the longest leaf blade whilist Hindi cultivar took the other way around. Moreover , the studied cultivars showed three levels of leaf blade length. On this basis , the first level had leaf blades of less than 200 cm. in length as for Hindi and Basrai cultivars. The second class ranged from 201 to 250 cm. Williams and Sindihi cultivars belonged to this class. In addition , the third group had leaf blades longer than 250 cm. which . included Poyo , Maghrabi ,paradica , Ambel , and Mohamed Ali cultivars.

In respect to the statistical analysis , data indicated that no significant differences were noticed between Poyo , Maghrabi , and Ambel cultivars , between Maghrabi , Ambel , and Mohamed Ali cultivars , and between Hindi and Basrai cultivars in this respect. On the contrary , differences between Hindi , Williams , Poyo , Paradica , Mohamed Ali , and Sindihi were almost significant.

These results are similar to those achieved by **Champion (1963) , Behairy (1968) , Purseglove (1978) , Robinson and Nel (1985) and Mayaz (1987).**

Table (4) : Leaf blade length , width and length / width ratio of different banana cultivars (1985/1986 and 1986/1987 seasons).

Cultivar	Leaf blade length (cm.)			Leaf blade width (cm.)			Leaf index (L/W)		
	85/86	86/87	Average	85/86	86/87	Average	85/86	86/87	Average
Hindi	161.50 a	164.30 a	162.90 a	82.00 bc	84.00 bc	83.00 c	1.97 b	1.96 b	1.97 b
Basrai	165.80 a	167.80 a	166.80 a	90.20 cd	92.00 cd	91.10 de	1.84 a	1.83 a	1.84 a
Williams	240.70 bc	239.30 b	240.00 c	94.50 d	94.00 d	94.25 e	2.55 c	2.55 c	2.55 c
Poyo	254.30 cd	257.50 c	255.90 d	73.80 ab	76.80 ab	75.30 ab	3.45 f	3.37 f	3.41 f
Maghrabi	262.00 d	261.80 c	261.90 de	88.00 cd	88.50 cd	88.25 d	2.98 d	2.96 d	2.97 d
Paradica	280.50 e	279.50 d	280.00 f	78.70 ab	79.50 ab	79.10 bc	3.56 j	3.52 j	3.54 j
Ambei	264.00 d	256.80 c	260.40 de	73.30 a	72.50 a	72.90 a	3.60 j	3.55 j	3.58 j
Mohamed Ali	290.00 e	291.80 e	290.90 e	91.50 d	91.70 cd	91.60 de	3.17 e	3.19 e	3.18 e
Sindihi	227.50 b	230.70 b	229.10 b	75.80 ab	77.8 ab	76.80 ab	3.01 d	2.97 d	2.99 d

Means followed by same letter (s), within each column, are not significantly different from each other at 5 % level.

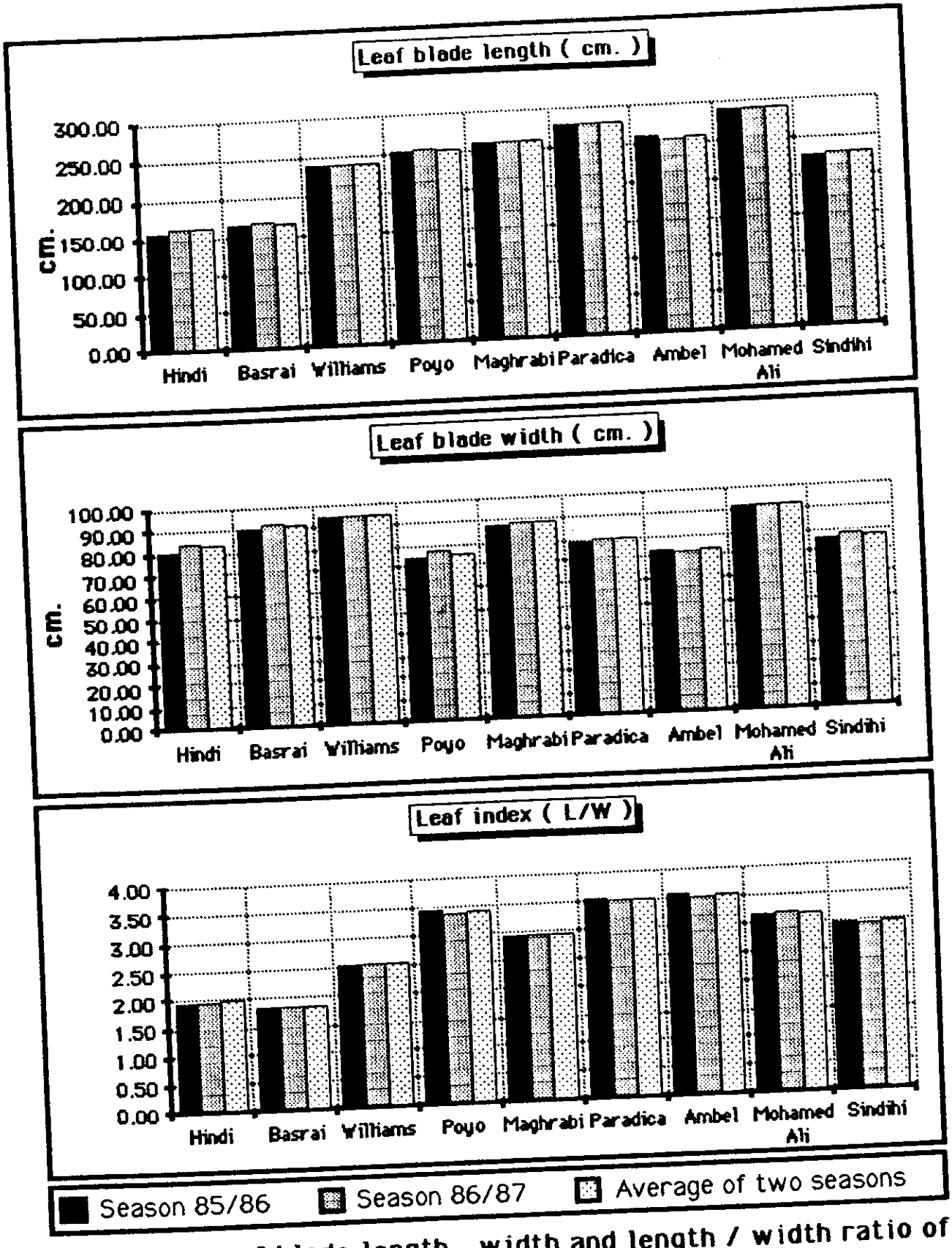

Fig. (4) : Leaf blade length , width and length / width ratio of different banana cultivars (1985/1986 and1986/1987 seasons).

4-I.8.2. Leaf blade width :

It is quite evident that banana cultivars varied in their leaf width from 72.88 to 94.25 cm. . In this respect , Ambel among the other cultivars under the study had the narrowest leaves while Williams cultivar gave the opposite trend. Somehow , banana cultivars could be divided into three groups with respect to leaf blade width. The first group included Poyo , Paradica , Ambel , and Sindihi cultivars with narrow leaves (< 80.0 cm.). The second group had leaves varied in their width from 80.0 to 85.0 cm. Hindi cultivar belonged to this group. The third class covered Basrai , Williams , Maghrabi , and Mohamed Ali cultivars with wide leaves (> 85.0 cm.).

Regarding to significant differences , it is obvious that Hindi , Williams , Poyo , Maghrabi and Ambel cultivars differed significantly. On the other hand , Poyo , Paradica and Sindihi cultivars were more or less statistically similar. Meanwhile , Basrai , Williams , and Mohamed Ali gave the same trend statistically.

These findings confirm those mentioned by **Champion (1963) , Behairy (1968) , Purseglove (1978) , Robinson and Nel (1985) and Mayaz (1987).**

4-I.8.3. Leaf index :

Leaf index of different banana cultivars is presented in **Table (4)** and demonstrated in **Fig. (4)**. It is well noticed that banana cultivars varied in this respect from 1.84 for Basrai to 3.58 for

Ambel. Moreover , data indicated that leaves of various cultivars had oblong shape mainly Poyo , Paradica , Ambel , and Mohamed Ali where values exceeded 3.0. Beside , Basrai and Hindi had values < 2.0 in this respect hence their leaves were wide. On the other hand , Williams , Maghrabi , and Sindihi cultivars had leaf index with intermediate values (2.55 - 3.00).

Considering statistical analysis , it is clear that Paradica and Ambel on one hand and Maghrabi and Sindihi on the other showed no significant differences. Furthermore , other cultivars showed statistically significant differences .

These results are in accordance to the findings of **Champion (1963) , Behairy (1968) , Purseglove (1978) , Robinson and Nel (1985) , and Mayaz (1987)** .

4-I.8.4. Leaf petiole length :

Table (5) and **Fig. (5)** illustrated that Hindi cultivar among other banana cultivars under study had leaves with the shortest petiole length (18.8 cm.) while Ambel plants had the longest leaves petiole (69.3 cm.). Moreover , data showed that leaf petiole length of different banana cultivars could be arranged in three groups. The first having petioles < 35 cm. in length as for Hindi , Basrai , Williams and Poyo cultivars. The second range was 35.0 - 52.5 cm. which resembled Maghrabi cultivar. The third class with long leaf petiole that is more than 52.5 cm. Paradica , Ambel , Mohamed Ali , and Sindihi cultivars belonged to this range.

Furthermore , no significant difference was noticed between Hindi and Basrai , between Williams , Poyo , and Maghrabi , between

Table (5) : Leaf petiole length , period from emergence to unfolding of leaf (full expansion) , leaf blade area and area coefficient of different banana cultivars . (1985/1986 and 1986/1987 seasons).

Cultivar	Leaf petiole length (cm.)			Period from emergence to unfolding of leaf (days)			Leaf blade area (cm^2)			Area coefficient *		
	85/86	86/87	Average	85/86	86/87	Average	85/86	86/87	Average	85/86	86/87	Average
Hindi	18.80 a	18.80 a	18.80 a	6.70 f	6.70 e	6.70 f	1.33 a	1.40 a	1.37 a	0.89 d	0.87 d	0.88 c
Basrai	19.50 a	19.30 a	19.40 a	6.60 ef	6.60 de	6.60 f	1.50 ab	1.55 ab	1.53 b	0.91 d	0.89 d	0.90 c
Williams	32.20 b	33.00 b	32.60 b	6.10 de	6.10 cd	6.10 e	2.28 d	2.25 de	2.27 e	0.87 cd	0.85 d	0.86 c
Poyo	33.80 b	34.00 b	33.90 b	5.80 cd	5.60 bc	5.70 d	1.88 c	1.98 cd	1.93 d	0.78 abc	0.76 bc	0.77 b
Maghrabi	36.20 b	36.00 b	36.10 b	5.50 bcd	5.30 b	5.40 c	2.31 d	2.35 e	2.33 f	0.79 bc	0.79 c	0.79 b
Paredica	63.00 cd	63.80 cd	63.40 cd	5.20 ab	5.20 b	5.20 b	2.21 d	2.20 de	2.21 e	0.69 a	0.71 a	0.70 a
Ambel	69.00 e	69.50 e	69.25 e	5.20 abc	5.40 b	5.30 bc	1.88 c	1.88 c	1.88 cd	0.70 ab	0.70 a	0.70 a
Mohamed Ali	60.00 c	59.50 c	59.75 c	4.80 a	4.40 a	4.60 a	2.66 e	2.68 f	2.67 j	0.74 ab	0.74 ab	0.74 ab
Sindihi	65.70 de	65.30 de	65.50 de	4.70 a	4.50 a	4.60 a	1.72 bc	1.80 bc	1.76 c	0.75 ab	0.73 ab	0.74 ab

* Leaf area coefficient = $\frac{\text{True area}}{\text{Length X width}}$

Means followed by same letter (s), within each column, are not significantly different from each other at 5 % level.

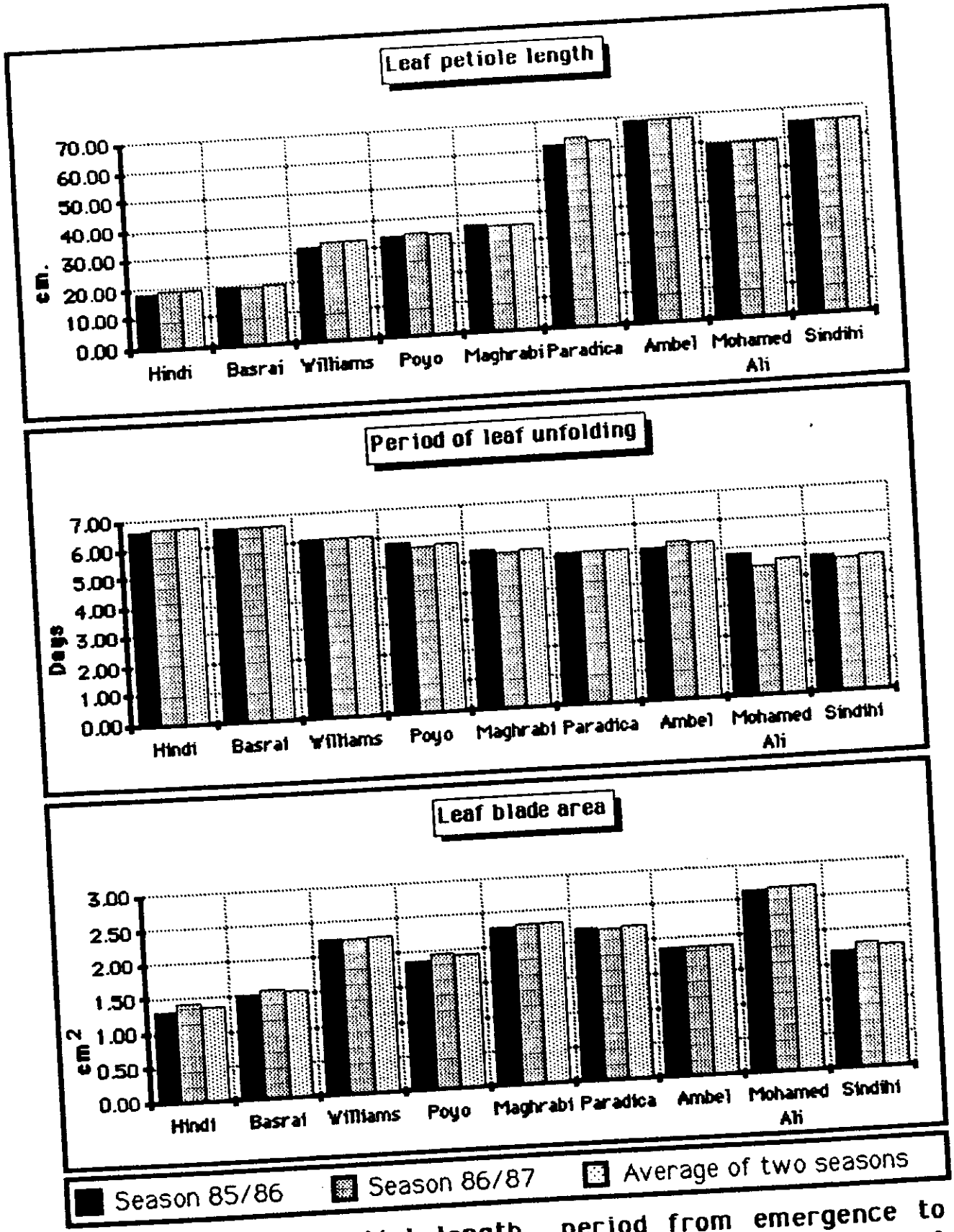

Fig. (5): Leaf petiol length, period from emergence to unfolding of leaf (full expansion) and leaf blade area of different banana cultivars(1985/1986 and1986/1987 seasons).

Paradica and Sindihi , between Ambel and Sindihi as well as between Paradica and Mohamed Ali. However , differences between Paradica, Ambel, Mohamed Ali , and Sindihi from one hand and the other studied banana cultivars on the other were so high to reach the significant level .

The varietal differences which were evident in this study are similar to those mentioned by **Purseglove (1978) and Samson (1982).**

4-I.8.5. Period from emergence to unfolding of leaf :

It is obvious from **Table (5)** and **Fig. (5)** that period in days from emergence to unfolding of banana leaf was shortest for Mohamed Ali , and Sindihi cultivars (4.6 days) while for Hindi and Basrai cultivars was longest (> 6.6 days). Moreover , banana cultivars could be divided into three classes in this sphere. The first group required less than 5.0 days for leaves to reach unfolding stage. That was true for Mohamed Ali and Sindihi cultivars. The second range was from 5.0 to 6.0 days for Paradica , Maghrabi , Ambel , and Poyo cultivars. Lastly , the third level required more than 6 days which covered Williams , Basrai , and Hindi cultivars.

With respect to significant differences between banana cultivars under study , disclosed data indicated that significancy between Mohamed Ali and Sindihi , between Paradica and Ambel , between Maghrabi and Ambel , and between Hindi and Basrai cultivars was lacking . In contrast , significant differences were appeared between Hindi , Williams , Poyo , Maghrabi , Paradica and Mohamed Ali banana cultivars.

4-I.8.7. Leaf area coefficient :

It is remarkable from **Table (5)** that leaf area coefficient for banana cultivars varied from 0.70 to 0.90 . In this respect , two levels were obvious for various banana cultivars under study. The first class ranged from 0.70 to 0.80 for Paradica (0.70) , Ambel (0.70) , Mohamed Ali (0.74) , Sindihi (0.74) , Poyo (0.77) , and Maghrabi (0.79). On the other side , the second level differed from 0.81 to 0.90 for Williams (0.86) , Hindi (0.88) and Basrai (0.90).

Considering statistical analysis for leaf area coefficient , it is well noticed that differences between Hindi , Basrai , and Williams , between Poyo , Maghrabi , Mohamed Ali , and Sindihi as well as between Paradica , Ambel , Mohamed Ali , and Sindihi cultivars were insignificant.

These findings are in agreement with those reported by **Obiefuna and Ndubizu (1979)**.

4-II. Flowering :

4-II.1. Number of female, hermaphrodite, male and total flower clusters per inflorescence:

4-II.1.1. Female flower clusters :

It is quite evident from **Table (6)** that the highest number of female flower clusters was noticed for Mohamed Ali cultivar while Sindihi tended to be the least one in this respect. Furthermore , various banana cultivars could be arranged in three groups in this concern. The first group has less than 11.0 female flower clusters as for Sindihi , Hindi , Basrai , Paradica , and Ambel cultivars. The second level from 11.00 to 12.25 for Williams , Poyo , and Maghrabi cultivars. The third group has more than 12.25 female flower clusters for Mohamed Ali cultivar.

Referring to statistical analysis for female flower clusters , it is remarkable that no significant differences were noticed between Hindi, Paradica and Sindihi , between Williams and Maghrabi , as well as between Basrai , Poyo , and Ambel . However , Mohamed Ali cultivar showed a significant difference as compared to the other studied cultivars.

These results go in line with the findings of **Alexaderowicz (1955) , Ochse (1961) , Freiberg (1966) , Simmonds (1966) , and Swidan (1972).**

Table (6) : Number of female , hermaphrodite , male , total flower clusters per inflorscence and female flower clusters percentage of different banana cultivars (1985/1986 and 1986/1987 seasons).

Cultivar	Female flower clusters No.			Hermaphrodite flower clusters No.			Male flower clusters No. (Per inflorescence)			Total number of flower clusters			Female flower clusters percentage		
	85/86	86/87	Average	85/86	86/87	Average	85/86	86/87	Average	85/86	86/87	Average	85/86	86/87	Average
Hindi	10.05 a	9.60 a	9.83 ab	60.00 a	59.00 a	59.50 a	36.05 c	36.60 b	36.33 c	105.10 a	106.20 a	105.65 a	9.57 d	9.06 d	9.32 d
Basrai	10.75 b	10.50 b	10.63 cd	58.00 a	58.50 a	58.25 a	35.70 c	36.33 b	36.02 c	104.95 a	104.83 a	104.89 a	10.27 e	10.05 e	10.16 f
Williams	12.00 c	12.10 c	12.05 f	76.00 b	71.25 b	73.63 b	26.65 b	26.38 a	26.52 b	109.90 a	114.35 a	112.13 a	10.93 f	10.59 f	10.76 j
Poyo	11.15 b	11.40 c	11.28 de	77.25 b	77.50 b	77.38 b	23.68 ab	23.68 a	23.68 a	115.15 ab	112.33 a	113.74 a	9.69 de	10.17 ef	9.93 e
Meghrabi	11.55 b	11.85 c	11.70 ef	75.00 b	77.00 b	76.00 b	25.20 ab	25.98 a	25.59 b	113.75 a	112.83 a	113.29 a	10.16 de	10.51 ef	10.34 f
Paradice	10.25 a	10.25 ab	10.25 abc	119.50 c	119.50 c	119.50 c	23.53 a	23.75 a	23.64 a	153.28 ab	153.50 ab	153.39 b	6.69 b	6.68 b	6.69 b
Ambel	10.75 b	10.45 b	10.60 bcd	122.00 c	121.25 d	121.63 c	23.78 ab	24.43 a	24.11 a	155.78 c	156.88 ab	156.33 b	6.92 b	6.66 b	6.79 b
Mohamed Ali	13.50 d	13.60 d	13.55 j	134.50 d	131.00 e	132.75 d	22.53 a	23.48 a	23.01 a	167.03 c	171.58 ab	169.31 b	8.08 c	7.93 c	8.01 c
Sindihi	9.35 a	9.75 ab	9.55 a	163.00 e	154.75 f	158.88 e	41.68 d	40.65 c	41.17 d	205.85 d	213.40 b	209.63 c	4.55 a	4.57 a	4.56 a

Means followed by same letter (s), within each column, are not significantly different from each other at 5 % level.

4-II.1.2. Hermaphrodite flower clusters :

As shown in **Table (6)** it is clear that banana cultivars differed in number of hermaphrodite flower clusters with the highest number for Sindihi cultivar and the lowest number for Basrai. However , differences between Hindi and Basrai , between Williams , Poyo , and Maghrabi , and between Paradica and Ambel cultivars were so small to reach the significant level. On the other hand , Mohamed Ali and Sindihi cultivars indicated a remarkable significant difference as compared with the previous cultivars. In addition , data also showed that three levels of number of hermaphrodite flower clusters were noticed. The first level with < 92 flowers as for Hindi , Basrai , Williams , Poyo and Maghrabi cultivars. The second level with a range of 92 - 125 for Paradica and Ambel Banana. The third group with above 125 flowers for Mohamed Ali and Sindihi cultivars.

These results are in harmony with those of **Alexandrowicz (1955) , Ochse (1961) , Freiberg (1966) , and Saad (1979).**

4-II.1.3. Male flower clusters :

Data presented in **Table (6)** showed that banana cultivars under study varied in their number of male flower clusters with the highest value for Sindihi cultivar and the lowest for Mohamed Ali. However , no significant difference was noticed between Hindi and Basrai , between Williams and Maghrabi and between Poyo , Paradica , Ambel , and Mohamed Ali cultivars . Nevertheless , significant differences between Sindihi and the other banana cultivars were obvious.

By all means , banana cultivars could be divided into two categories in this respect. The first one ranged with less than 32 flowers which covered most cultivars i.e. Williams , Poyo , Maghrabi , Paradica , Ambel , and Mohamed Ali. On the other hand , the second class having more than 32 male flowers as for Hindi , Basrai , and Sindihi cultivars.

Male flower clusters number in this study go in line with the findings of **Alexanderowicz (1955) , Ochse (1961) , Freiberg (1966) , and Saad (1979).**

4-II.1.4. Total number of flower clusters:

Data presented in **Table (6)** indicated that banana cultivars differed in their values of total number of flower clusters. However , differences between Hindi , Basrai , Williams , Poyo , and Maghrabi and between Paradica , Ambel and Mohamed Ali cultivars were so little to reach the significant level. On the other hand , Sindihi cultivar was significantly different as compared to the other cultivars under study.

Beside , data showed also that banana cultivars lied in under three groups. The first group with less than 140 flower clusters for Hindi , Basrai , Williams , Poyo , and Maghrabi. The second group from 140 to 175 included Paradica , Ambel , and Mohamed Ali cultivars . The third class with higher than 175 clusters as for Sindihi cultivar.

The varietal differences which were evident in this study are similar to those previously mentioned by **Alexandrowicz (1955) . Ochse (1961) . Freiberg (1966) . Swidan (1972) . and Saad (1979) .**

4-II.2. Female flower clusters percentage :

It is quite evident from **Table (6)** that banana cultivars varied in their values of female flower clusters percentage. The highest cultivar was Williams whilist the lowest one was Sindihi. Moreover , there were no significancy between Basrai and Maghrabi cultivars , between Basrai and Poyo cultivars and between Paradica and Ambel cultivars. Differences between other cultivars were almost significant.

Anyway , banana cultivars under study gave three categories in this respect. The first range was lower than 6.6 % as for Sindihi cultivar. The second group varied from 6.6 to 8.6 %. That was true for Paradica , Ambel and Mohamed Ali cultivars. The third level having more than 8.7 % which involved most banana cultivars under study i.e. Poyo , Maghrabi , Hindi , Basrai , and Williams.

These results coincided with the findings of **Alexandrowicz (1955) . Swidan (1972) . and Saad (1979).**

4-II.3. Male bud characters :

4-II.3.1. Male bud length :

As shown in **Table (7)** it is remarkable that banana cultivars under study varied in their values of male bud length with the highest one for Paradica cultivar and the lowest for Mohamed Ali cultivar . However , significant differences between Hindi , Basrai and Sindihi , between Basrai , Williams , Poyo , and Maghrabi , between Ambel and Mohamed Ali were almost abscent. On the contrary , Paradica cultivar was appreciably different as compared to the other studied cultivars. Furthermore , three ranges for banana cultivars in this concern could put into account. The first group had a range below 17.5 cm. as for Mohamed Ali , Ambel , Maghrabi and Williams cultivars. Beside , the second level differed from 17.5 to 25.1 cm. for Poyo , Basrai , Hindi and Sindihi cultivars. The third group having male bud longer than 25.1 cm. as for Paradica cultivar.

Unfortunately , male bud length of different banana cultivars was scarce in the literature .

4-II.3.2. Male bud girth :

It is well noticed from **Table (7)** that banana cultivars varied in their male bud girth from 13.00 cm. for Mohamed Ali to 33.50 cm. for Sindihi. Anyhow , other cultivars lied in between in this sphere. However , differences between Hindi , Basrai and Paradica , and between Williams , Poyo , and Maghrabi were so little to reach statistically the significant level . On the other hand , differences

Table (7) : Male bud length , girth and weight , as well as male axis length of different banana cultivars (1985/1986 and 1986/1987 seasons).

Cultivar	Length (cm.)			Girth (cm.)			Weight (gm.)			Male axis length (cm.)		
	85/86	86/87	Average	85/86	86/87	Average	85/86	86/87	Average	85/86	86/87	Average
Hindi	20.50 de	22.50 e	21.50 cd	29.80 c	30.80 e	30.30 d	426.50 d	432.50 d	429.50 f	51.50 a	52.70 a	52.10 a
Basrai	18.60 cd	20.00 cde	19.30 bcd	28.00 c	29.80 e	28.90 d	445.30 d	444.50 d	444.90 f	50.00 a	51.80 a	50.90 a
Williams	15.80 c	18.00 cd	16.90 b	22.00 b	23.80 cd	22.90 c	335.00 c	339.80 c	337.40 e	63.20 b	67.00 b	65.10 b
Poyo	17.50 cd	19.50 cde	18.50 bc	20.50 b	23.30 c	21.90 c	288.70 b	301.30 bc	295.00 d	69.20 bc	72.00 b	70.60 c
Maghrabi	16.50 c	16.70 bc	16.60 b	20.70 b	21.50 bc	21.10 c	255.00 b	265.20 b	260.10 c	70.50 c	69.70 b	70.10 c
Paradica	33.00 f	32.60 f	32.80 c	29.70 c	29.30 de	29.50 d	640.70 e	639.50 e	640.10 h	134.30 f	135.30 e	134.80 f
Ambel	12.00 b	13.00 ab	12.50 a	14.50 a	17.30 ab	15.90 b	68.50 a	69.30 a	68.90 b	84.30 d	86.50 c	85.40 d
Mohamed Ali	9.50 a	10.30 a	9.90 a	13.00 a	13.00 a	13.00 a	49.70 a	50.00 a	49.85 a	83.50 d	82.30 c	82.90 d
Sindihi	22.30 e	21.50 de	21.90 d	33.70 d	33.30 e	33.50 e	782.60 f	778.00 f	780.30 j	96.00 e	97.00 d	96.50 e

Means followed by same letter (s), within each column, are not significantly different from each other at 5 % level.

between Maghrabi , Paradica , Ambel , Mohamed Ali , and Sindihi ever so little were significant.

Furthermore , three ranges were observed in this respect. The first one is below 20 cm. for Mohamed Ali and Ambel cultivars. The second class differed from 20.0 to 26.7 cm. which covered Maghrabi , Poyo , and Williams cultivars . Lastly , the third category was above 26.7 cm. That was true for Paradica , Basrai . Hindi , and Sindihi banana cultivars.

Male bud girth of different banana cultivars was not enough in the literature to cover our results .

4-II.3.3. Male bud weight :

Disclosed data presented in **Table (7)** declare that banana cultivars differed obviously in male bud weight. Thus , the heaviest cultivar was Sindihi whilist the lightest one was Mohamed Ali. Moreover , significant difference between Hindi and Basrai was lacking. On the contrary , differences between the other cultivars under study were so high to reach the significant level.

Furthermore , banana cultivars lied in under three ranges as male bud weight was concerned. The first range was below 295 gm. for Mohamed Ali , Ambel , and Maghrabi cultivars. The second one varied from 295 to 540 gm. which included Poyo , Williams , Hindi , and Basrai cultivars. The third class was above 540 gm. as for Paradica and Sindihi cultivars.

Anyhow , male bud weight of different banana cultivars was not available in the literature.

4-II.4. Male axis length :

Referring to male axis length (cm.) for various banana cultivars under study , **Table (7)** clearly show that male axis length differed from one cultivar to another. The tallest one was Paradica cultivar while the shortest was Basrai. Other cultivars , anyhow , had values in between. However , significant difference was disappeared between Hindi and Basrai , between Poyo and Maghrabi , and between Ambel and Mohamed Ali cultivars . Other cultivars were statistically significant.

Furthermore , banana cultivars were arranged in three levels concerning male axis length. Thus , the first range having main axis shorter than 80 cm. for Basrai , Hindi , Williams , Poyo , and Maghrabi cultivars. The second one from 80 to 106 cm. which was true for Ambel , Mohamed Ali and Sindihi cultivars . The third class was above 106 cm. as for paradica cultivar.

These results go in line with the findings of **Ochese et al (1961) , Purseglove (1978) , and Chakarabarty and Rao (1980).**

4-II.5. Bunch shooting percentage during April to October :

Bunch shooting percentages during the period from April to October are presented in **Table (8)** and **Fig. (6- a, b and c).** It is clearly noticed that Hindi and Basrai cultivars started bunch

Table (6) : Bunch shooting percentage of different banana cultivars during the period from April to October (1985/1986 and 1986/1987 seasons).

Cultivar	April			May			June			July			August			September			October		
	85/86	86/87	Average	85/86	86/87	Average	85/86	86/87	Average	85/86	86/87	Average	85/86	86/87	Average	85/86	86/87	Average	85/86	86/87	Average
Hindi	0.00 a	0.00 a	0.00 a	0.00 a	0.00 a	0.00 a	10.00 a	5.20 a	7.60 a	40.00 bc	19.00 a	29.50 bc	28.30 c	34.30 cd	31.30 e	11.70 b	29.10 b	20.40 b	10.00 b	12.40 b	11.20 b
Basrai	0.00 a	0.00 a	0.00 a	0.00 a	0.00 a	0.00 a	10.00 a	5.00 a	7.50 a	58.40 cd	17.60 a	38.00 cd	11.70 b	30.10 bcd	20.90 bcd	10.00 b	37.20 b	23.60 b	10.00 b	10.00 b	10.00 b
Williams	0.00 a	0.00 a	0.00 a	3.40 a	0.00 a	1.70 a	18.40 ab	15.00 a	16.70 ab	66.70 d	33.30 a	50.00 de	6.50 ab	38.30 d	23.40 de	0.00 a	10.80 a	5.40 a	0.00 a	0.00 a	0.00 a
Poyo	0.00 a	0.00 a	0.00 a	1.60 a	0.00 a	0.80 a	20.00 abc	19.20 ab	19.60 b	65.00 d	35.00 a	50.00 de	13.30 b	33.30 cd	23.30 cde	0.00 a	12.60 a	6.30 a	0.00 a	0.00 a	0.00 a
Maghrabi	0.00 a	0.00 a	0.00 a	3.40 a	0.00 a	1.70 a	16.70 ab	15.10 a	15.90 ab	70.00 d	55.00 b	62.50 e	5.00 a	20.00 abc	12.50 abc	0.00 a	7.60 a	3.80 a	0.00 a	0.00 a	0.00 a
Paradica	20.00 c	19.60 c	19.80 c	33.40 b	25.20 b	29.30 b	40.00 a	28.20 ab	34.10 c	0.00 a	22.20 a	11.10 a	0.00 a	5.20 a	2.60 a	0.00 a	0.00 a	0.00 a	0.00 a	0.00 a	0.00 a
Ambel	6.70 ab	12.70 b	9.70 b	26.70 b	23.10 b	24.90 b	35.00 de	35.00 b	35.00 c	18.40 a	19.20 a	18.80 ab	10.00 b	12.60 ab	11.30 ab	0.00 a	0.00 a	0.00 a	0.00 a	0.00 a	0.00 a
Mohamed Ali	0.00 a	0.00 a	0.00 a	23.30 b	22.30 b	22.80 b	25.00 bcd	27.60 ab	26.30 bc	26.30 ab	31.70 a	30.00 bc	23.40 c	18.40 abc	20.90 bcd	0.00 a	0.00 a	0.00 a	0.00 a	0.00 a	0.00 a
Sindihi	11.60 b	15.00 bc	13.30 b	23.50 b	23.30 b	23.40 b	33.40 cde	34.20 b	33.80 c	20.00 ab	20.80 a	20.40 ab	6.50 ab	6.70 a	7.60 a	0.00 a	0.00 a	0.00 a	0.00 a	0.00 a	0.00 a

Means followed by same letter (s), within each column, are not significantly different from each other at 5 % level.

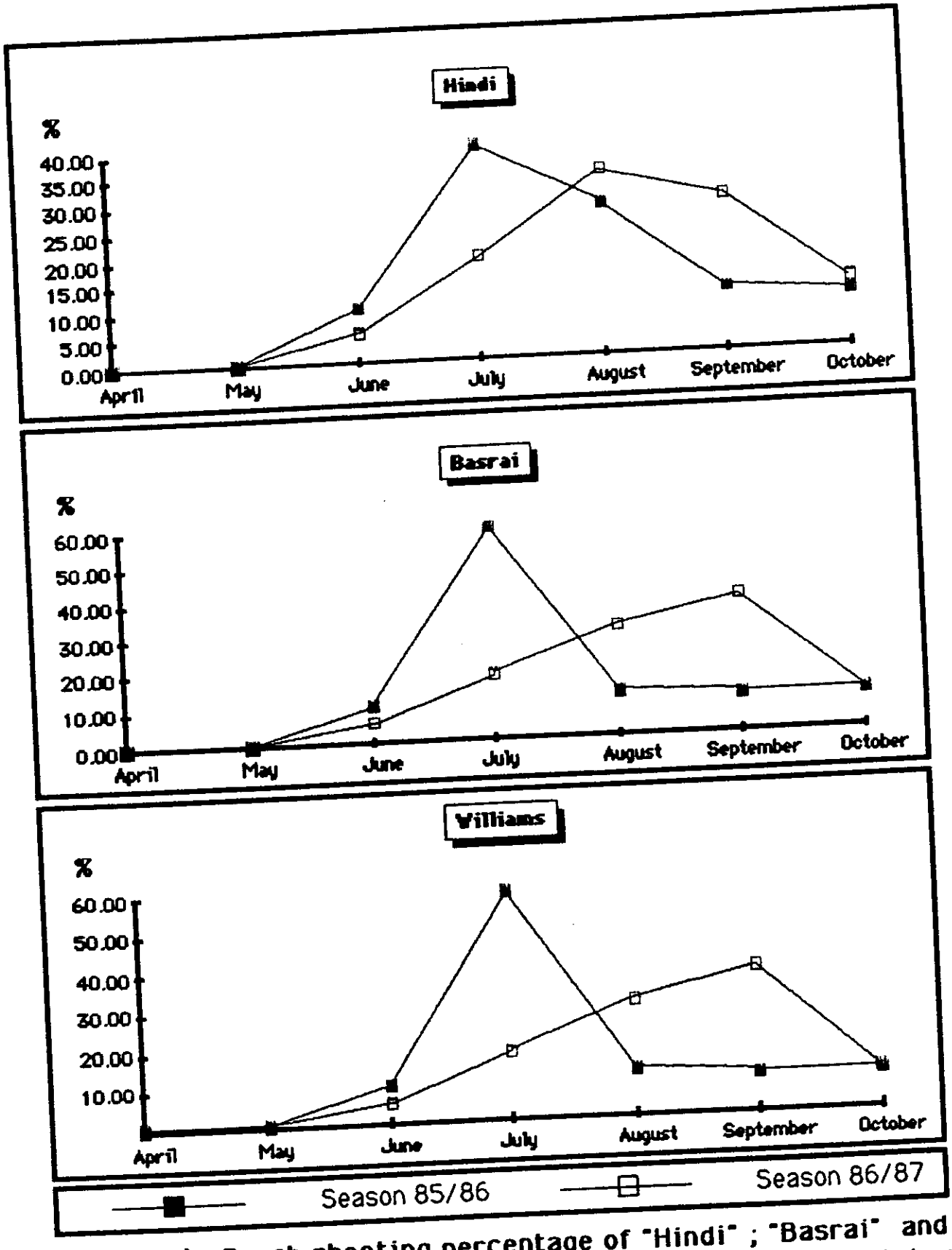

Fig. (6-a) : Bunch shooting percentage of "Hindi" ; "Basrai" and "Williams" cultivars during the period from April to October (1985/1986 and 1986/1987 seasons).

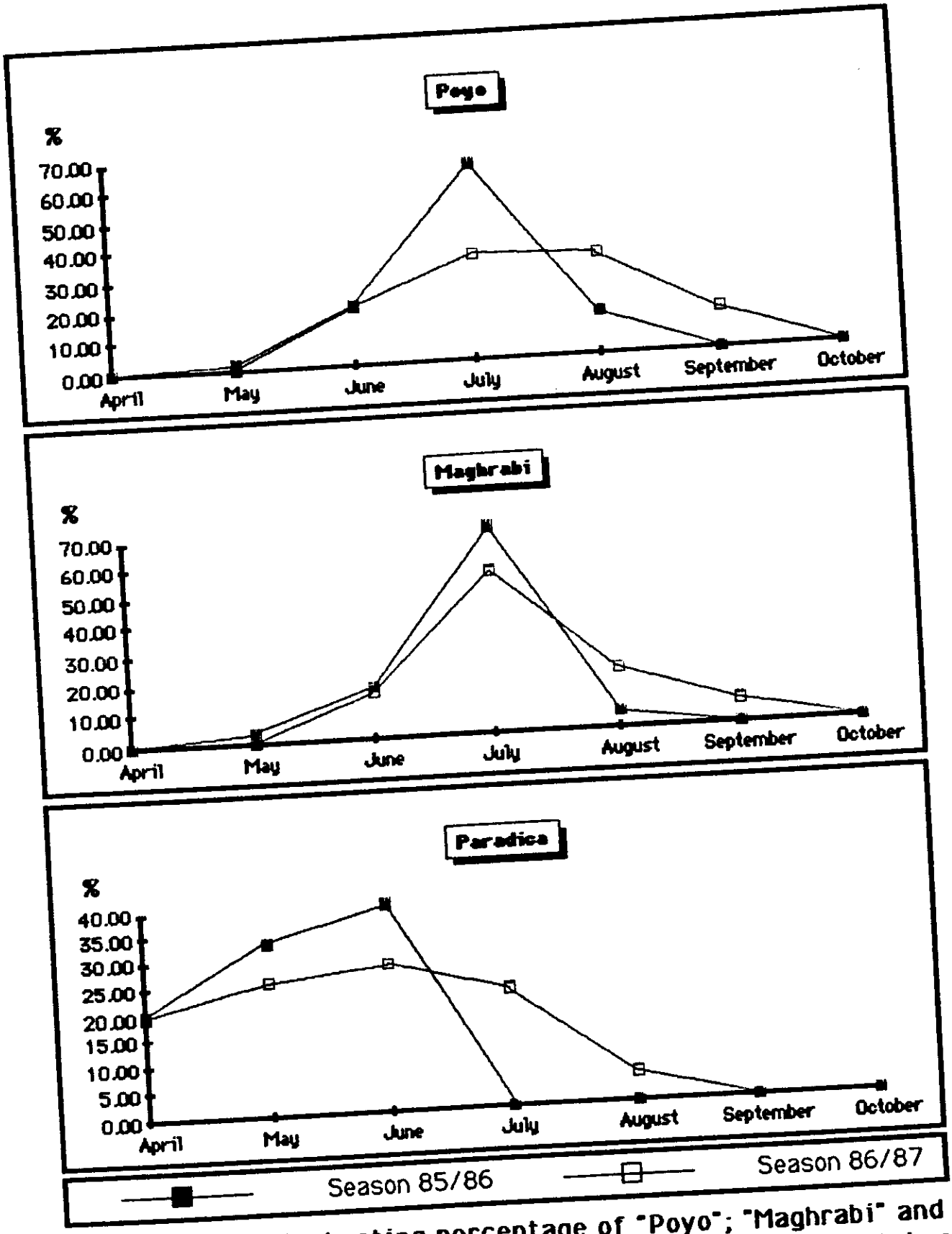

Fig. (6-b) :Bunch shooting percentage of "Poyo"; "Maghrabi" and "Paradica" cultivars during the period from April to October (1985/1986 and 1986/1987 seasons).

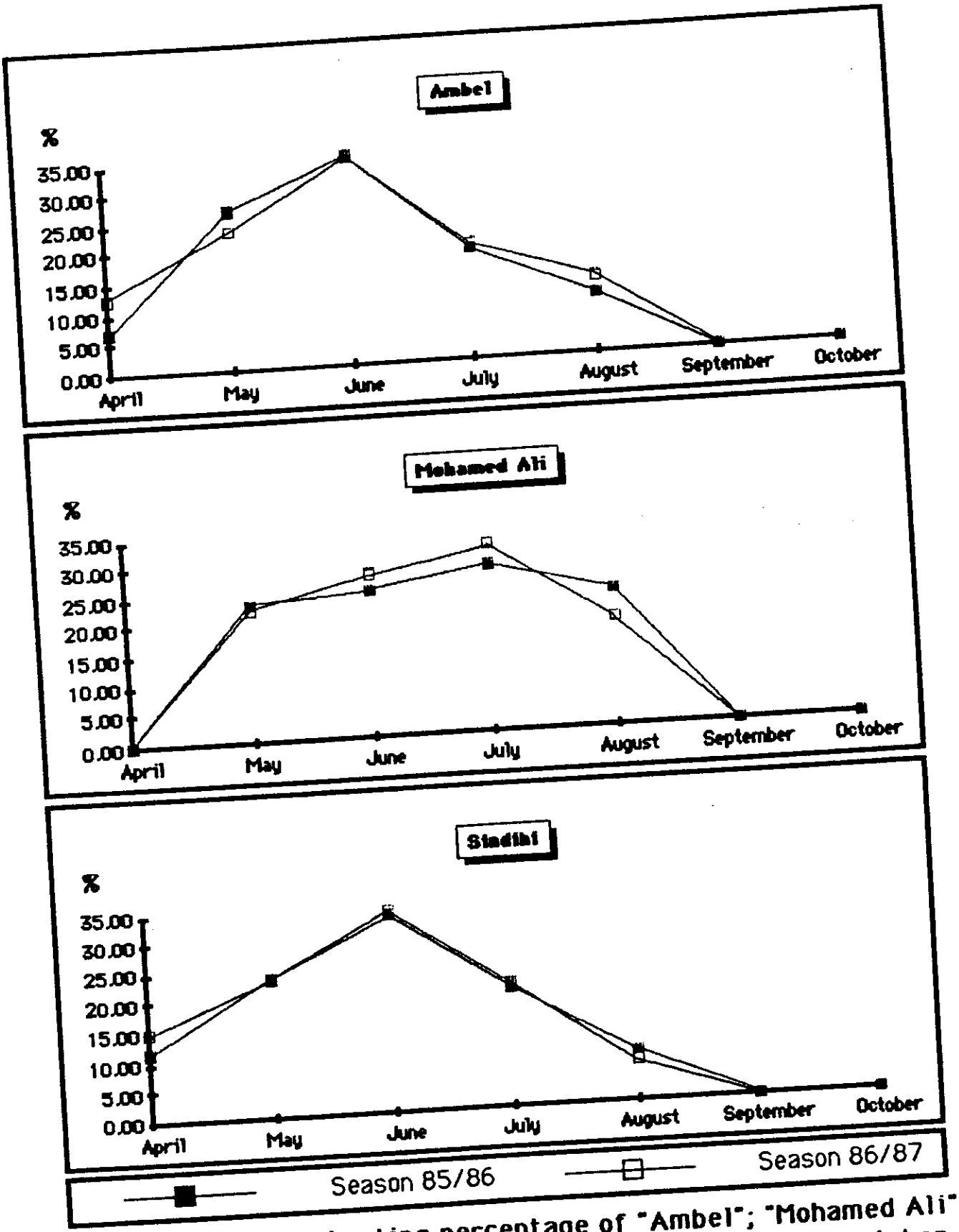

Fig. (6-c) :Bunch shooting percentage of "Ambel"; "Mohamed Ali" and "Sindihi" cultivars during the period from April to October (1985/1986 and 1986/1987 seasons).

shooting with low values in June then increased to reach the peak in August for Hindi and in July for Basrai followed with a decrease toward October at which bunch shooting was terminated.

Concerning Williams , Poyo , Maghrabi , and Mohamed Ali cultivars , data showed that bunch shooting started with low percentages in May then increased till July , and tended to decrease up to September. However , Mohamed Ali cultivar finished bunch shooting early in August.

Furthermore, Paradica , Ambel and Sindihi cultivars started bunch shooting in April with low percentages then increased toward June followed with a stout decrease till August.

Generally , it is easy to conclude that Paradica , Ambel , and Sindihi cultivars were earlier in bunch shooting (April) followed with Williams , Poyo and Maghrabi (May). But , Hindi , and Basrai cultivars were the latest ones in bunch shooting (June).

As for bunch shooting of banana cultivars in each month solely, it is clear that in April , Paradica , Ambel , and Sindihi cultivars varied significantly in bunch shooting. Other cultivars were void of bunch shooting during April. By all means , Paradica cultivar gave the highest percentage of bunch shooting followed with Sindihi and Ambel cultivars in descending order.

Beside , in May banana cultivars varied in bunch shooting percentages with the highest value for Paradica and the lowest for Poyo. Other studied cultivars were in between . However , Hindi and Basrai cultivars were still deprived of bunch shooting during this month.

In regard to statistical point of view , significant differences between Williams , Poyo , and Maghrabi as well as between Paradica, Ambel , Mohamed Ali and Sindihi cultivars were nil .

In June , bunch shooting percentage was the least for Hindi and Basrai cultivars while it was the highest for Paradica , Ambel , Mohamed Ali , and Sindihi cultivars. Other cultivars were in between in this respect. Moreover , Hindi , Basrai , Williams and Maghrabi cultivars as a group beside Williams , Poyo , and Maghrabi as another one as well as Paradica , Ambel , Mohamed Ali and Sindihi cultivars were statistically more or less similar since there were no significancy within each group.

In July , banana cultivars varied in their percentages with the highest values for Maghrabi , Poyo , and Williams. On the other hand , the lowest cultivar in bunch shooting was Paradica. Other cultivars were intermediate in their values.

Referring to statistical analysis , the obtained data declared that differences between Williams , Poyo , and Maghrabi , between Hindi , Ambel , Mohamed Ali and Sindihi , between Hindi and Basrai , and between Paradica , Ambel and Sindihi cultivars , were almost insignificant.

In August , banana cultivars decreased strongly in bunch shooting and in the mean time differed in their values. In this respect , the highest value was observed for Hindi cultivar while Paradica cultivar took the other way around. Furthermore , differences between Basrai , Williams , Poyo , and Mohamed Ali , between Maghrabi , Paradica , Ambel , and Sindihi , between Hindi , Williams and Poyo were so small to reach the significant level.

Regarding September , the picture was changed where plants of Paradica , Ambel , Mohamed Ali , and Sindihi cultivars became free from bunch shooting . Nevertheless , Basrai and Hindi cultivars were the highest in their values. Other cultivars i.e. Williams , Poyo , and Maghrabi cultivars were less in this respect. However , significant differences between Hindi and Basrai as well as between Williams , Poyo , and Maghrabi cultivars were lacking.

In October , only Hindi and Basrai cultivars gave bunches with low values of bunch shooting percentages while other cultivars under study failed completely to give bunches during this month . Anyhow, no significant difference was observed between Hindi and Basrai cultivars.

These results are in agreement with that reported by **Sanchez Nieva and others (1970) , Tadros et al (1987) , and Abd El-Naby (1988).**

4-II.6 Period from suckers emergence to bunch shooting :

It is quite evident from **Table (9)** and **Fig. (7)** that suckers of banana cultivars required from 13 to 16 months to reach bunch shooting stage. In this respect , suckers of Paradica cultivar reached bunch shooting rapidly (12.9 months) than the other cultivars while suckers of Basrai and Hindi cultivars reached bunch shooting stage much later 15.5 and 15.4 months , respectively. Moreover , data also indcated that suckers of Ambel , Mohamed Ali , and Sindihi cultivars required nearly 13 months for reaching bunch shooting

Table (9) : Period from : Suckers emergence to bunch shooting , bunch shooting to harvesting and the cropping cycle* of different banana cultivars (1985/1986 and 1986/1987 seasons).

Cultivar	Period from suckers emergence to bunch shooting (months)			Period from bunch shooting to harvesting (months)			Period of cropping cycle (months)		
	85/86	86/87	Average	85/86	86/87	Average	85/86	86/87	Average
Hindi	15.00 e	15.70 d	15.35 d	4.20 d	4.30 c	4.25 c	19.30 h	20.00 h	19.65 j
Basrai	14.80 a	16.10 d	15.45 d	4.30 d	4.50 d	4.40 d	19.00 j	20.70 i	19.85 h
Williams	14.20 d	14.60 c	14.40 c	3.60 c	3.30 b	3.45 b	17.80 f	17.90 f	17.85 f
Poyo	14.20 d	14.40 c	14.30 c	3.50 bc	3.40 b	3.45 b	17.70 e	17.80 e	17.75 e
Maghrabi	14.20 d	14.60 c	14.40 c	3.40 b	3.50 b	3.45 b	17.60 e	18.00 j	17.80 e
Paradica	12.50 a	13.30 ab	12.90 a	2.60 a	2.40 a	2.50 a	15.10 a	15.70 b	15.40 a
Ambel	13.20 b	13.20 ab	13.20 a	2.60 a	2.50 a	2.55 a	15.80 c	15.70 c	15.75 c
Mohamed Ali	13.70 c	13.70 b	13.70 b	2.50 a	2.50 a	2.50 a	16.20 d	16.10 d	16.15 d
Sindihi	13.20 b	13.00 a	13.10 a	2.60 a	2.50 a	2.55 a	15.70 b	15.50 a	15.60 b

* Cropping cycle = The period between suckers emergence to harvesting time.

Means followed by same letter (s), within each column, are not significantly different from each other at 5 % level.

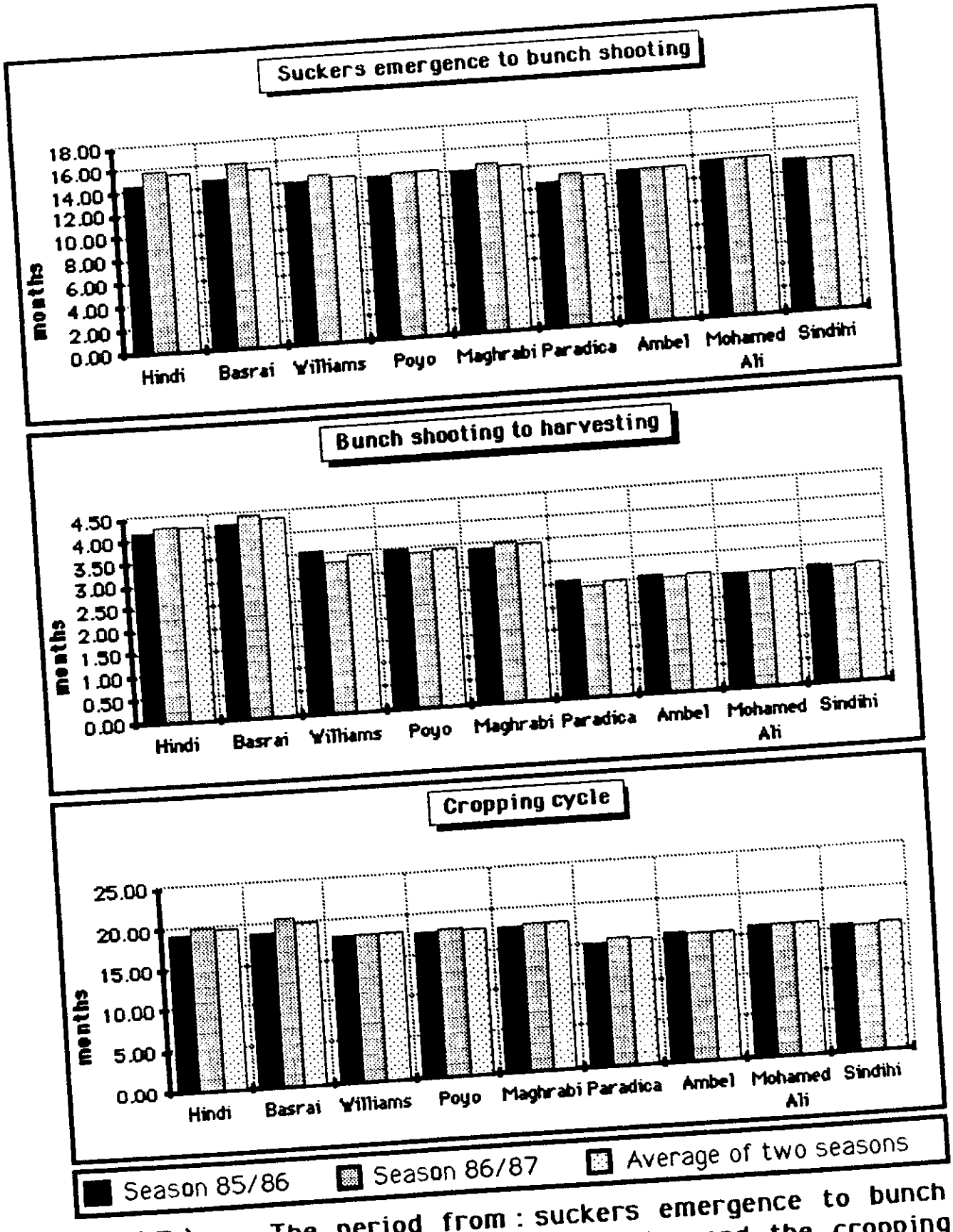

Fig. (7): The period from : suckers emergence to bunch shooting, bunch shooting to harvesting and the cropping cycle of different banana cultivars (1985/1986 and 1986/1987 seasons).

while Williams , Poyo and Maghrabi cultivars required nearly 14.5 months in this sphere.

Concerning banana cultivars from the statistical point of view , it is well noticed that no significant differences were remarked between Hindi and Basrai , between Williams , Poyo and Maghrabi , and between Paradica , Ambel , and Sindihi cultivars. In contrast , Mohamed Ali cultivar gave a significant difference as compared to the other cultivars under study in this concern.

The obtained findings confirm the results obtained by **Venkatesam (1955) , Walker (1970) , Alagiamanavalan (1973 and 1975) , Ahmed (1974) Lassoudiere (1974) , Purseglove (1978) , Robinson and Alberts (1983) , Holder and Gumbs (1983 - a) and Abd El-Naby (1988).**

4-II.7. Period from bunch shooting to harvesting :

It is obvious from **Table (9)** and **Fig. (7)** that banana cultivars varied in the period from bunch shooting to harvesting from 2.5 to 4.4 months. The shortest period (2.5 months) was noticed for Paradica and Mohamed Ali cultivars while the longest period (4.4 months) was remarked for Basrai cultivar. Other cultivars lied in between in this sphere. In other words , Paradica , Ambel , Mohamed Ali , and Sindihi cultivars needed about 2.5 months for bunches to reach harvesting.

Moreover , Williams , Poyo and Maghrabi cultivars required nearly 3.5 months in this respect. On the other hand , bunches of

Hindi and Basrai cultivars required longest time (4.3 months) for reaching harvesting.

With respect to statistical analysis , it is quite evident that no significancy was noticed between Paradica , Ambel , Mohamed Ali and Sindihi cultivars and between Poyo and Maghrabi cultivars. Other studied cultivars took the other way around in this concern.

These results were in agreement with that concluded by **Smirin (1960) , Venkatesam (1965) , Youssef (1968) , Walker (1970) , Twyford and Walmsly (1973) , Lassoudier (1974) , Shawky (1974) , Alagiamanavalan (1975) , Ito and Atubra (1977) , Purseglove (1978) , Stover (1979) , Kuhne (1980) , Robinson (1981) , Samson (1982) , Abdulah (1985), Robinson and Nel (1985) , and Abd El-Naby (1988).**

4-II.8. Cropping cycle :

Data presented in **Table (9)** and **Fig. (7)** clearly showed that banana cultivars varied their values from 15.4 months for Paradica to 19.9 months for Basrai cultivar. Moreover , Paradica , Ambel Mohamed Ali , and Sindihi cultivars required about 15.7 months for cropping cycle while Williams , Poyo and Maghrabi cultivars were intermediate in this respect where these cultivars needed nearly 17.8 months. Beside , both Hindi and Basrai cultivars required longest time (19.7 months) for cropping cycle.

Referring to differences between various banana cultivars under study data indicated that all cultivars except Poyo and Maghrabi cultivars were statistically significant.

These findings are in agreement with the results obtained by **Smirin (1960) . Champion (1963) . Walker (1970) . Alagiamanavalan (1973) . Twyford and Walmsly (1973) . Lassoudier (1974) . Ito and Atubra (1977) . Robinson (1981) . Biswas and Hassain (1982) . Holder and Gumbs (1983 - a) . Robinson and Alberts (1983) . Azhakiamavalan (1984) . Robinson and Nel (1985) . and Mayaz (1987).**

4-III. Yield and fruit quality :

4-III.1. Bunch characters :

4-III.1.1. Bunch length :

Bunch length in cm. of various banana cultivars is presented in **Table (10)** and graphically illustrated in **Fig. (8).** It is obvious that banana cultivars varied in their bunch length from 75.3 cm. for Ambel (the shortest cultivar) to 105.8 cm. for Williams (the longest one). However , banana cultivars under study lied in three ranges in this respect. The first range was below 85.5 cm. and that was true for Ambel , Mohamed Ali , Sindihi and Hindi cultivars. The second one differed from 85.6 to 95.5 cm. for Basrai and Paradica cultivars. Finally , the third group exceeded 95.6 cm. for Williams , Poyo and Maghrabi cultivars. Anyhow , banana cultivars showed no significancy between Hindi , Basrai and Mohamed Ali cultivars , between Williams , Poyo , and Maghrabi cultivars , between Ambel , Mohamed Ali , and Sindihi cultivars , and between Hindi , Basrai and Paradica cultivars.

The available literature on bunch length were mentioned by **Swidan (1972) , Chakerabarty and Rao (1980) , El-Khoreiby (1980) , and Abd El-Naby (1988)** which confirmed our findings.

Table (10) : Bunch length , bunch weight , stalk weight and stalk percentage of different banana cultivars (1985/1986 and 1986/1987 seasons).

Cultivar	Bunch Length (cm.)			Bunch weight (kg.)			Stalk weight (kg.)			Stalk percentage (kg.)		
	85/86	86/87	Average	85/86	86/87	Average	85/86	86/87	Average	85/86	86/87	Average
Hindi	85.20 ab	85.30 c	85.25 bc	15.80 bc	15.50 b	15.65 b	1.10 a	1.01 a	1.06 a	7.06 bcd	6.52 b	6.79 bc
Basrai	87.20 abc	87.20 c	87.20 bc	19.50 cd	19.70 d	19.60 cd	1.16 ab	1.26 b	1.21 b	5.93 abc	6.37 b	6.15 ab
Williams	105.60 e	106.00 f	105.80 d	26.40 e	26.80 f	26.60 f	1.15 ab	1.46 d	1.31 b	4.39 a	5.43 a	4.91 a
Poyo	103.10 de	103.10 ef	103.10 d	22.20 d	22.60 e	22.40 e	1.20 abc	1.27 b	1.24 b	5.43 ab	5.60 a	5.52 ab
Maghrabi	101.00 cde	101.80 e	101.40 d	22.60 d	22.80 e	22.70 e	1.29 abc	1.24 b	1.27 b	5.76 abc	5.42 a	5.59 ab
Paradica	91.00 bcd	91.10 d	91.05 c	19.00 bcd	17.80 c	18.40 c	1.41 bc	1.59 d	1.50 c	7.44 cd	9.01 d	8.23 de
Ambel	75.40 a	75.10 a	75.25 a	8.50 a	8.50 a	8.50 a	1.14 ab	1.30 bc	1.22 b	13.76 e	15.35 e	14.56 f
Mohamed Ali	80.40 ab	80.20 b	80.30 ab	15.10 b	15.10 b	15.10 b	1.42 bc	1.41 bcd	1.42 c	9.40 d	9.36 d	9.38 e
Sindihi	75.50 a	78.60 ab	77.05 a	20.60 d	20.10 d	20.35 d	1.47 c	1.58 d	1.53 c	7.13 cd	7.87 c	7.50 cd

Means followed by same letter (s), within each column, are not significantly different from each other at 5 % level.

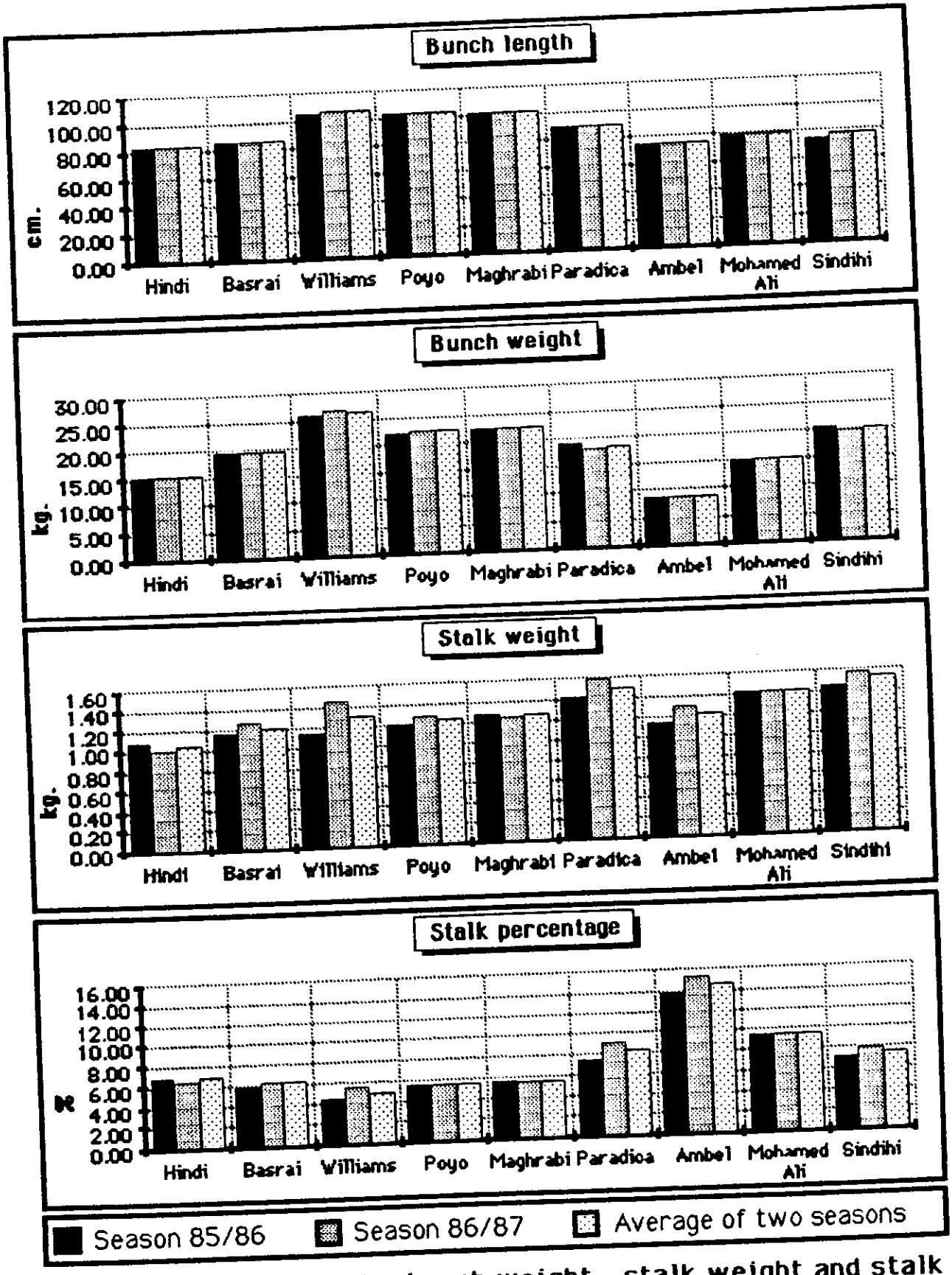

Fig. (8) : Bunch length , bunch weight , stalk weight and stalk percentage of different banana cultivars (1985/1986 and 1986/1987 seasons).

4-III.1.2. Bunch weight :

Bunch weight of various banana cultivars is shown in **Table (10)** and **Fig. (8).** It is clearly observed that banana cultivars differed in their bunch weight. However , the heaviest bunches belong to Williams (26.6 kg.) while the lightest ones were for Ambel (8.5 kg.). Other cultivars were scattered between these two extremes. Anyway , no significant differences were noticed between Poyo and Maghrabi , between Hindi and Mohamed Ali , between Basrai and Sindihi , and between Basrai and Paradica cultivars. By all means , bunch weight of Williams cultivar varied signifcantly as compered with other banana cultivars under study.

Furthermore , data indcated also that banana cultivars lied under three groups. The first range was below 14 kg. / bunch for Ambel cultivar (lightest one). The second class differed from 14.1 to 20.6 kg. for Mohamed Ali , Hindi , Basrai , Sindihi , and Paradica. The heaviest cultivars exceeded 20.7 kg. / bunch. That was true for Williams , Poyo , and Maghrabi cultivars.

Varietal differences in bunch weight of different banana cultivars were mentioned by **Anon (1945) , Venkatesam et al (1965) , Sanchez Nieva and others (1970) , Walker (1970) , Malik and Ahmed (1972) , Twyford and Walmsley (1973) , Lassoudiere (1974), Shawky et al (1974) , Alagiamanavalan et al (1975) , Ibrahim (1976) , Ito and Atubra (1977) , Abd El-Kader (1979) , Robinson (1981) , Holder and Gumbs (1983 - a) , Israeli (1985) , Abou-Aziz et al (1987) , Mayaz (1987) , and Tadros et al (1987).**

4-III.1.3. Stalk weight :

Data shown in **Table (10)** and **Fig. (8)** indicated that banana cultivars varied in stalk weight from 1.06 kg. for Hindi to 1.53 kg. for Sindihi. Other cultivars were in between. Moreover , results also showed that Hindi banana only differed significantly than those of other cultivars. However , significant differences were abscent between Basrai , Williams , Poyo , Maghrabi and Ambel cultivars , as well as between Paradica , Mohamed Ali , and Sindihi cultivars.

Furthermore , three categories were noticed in this respect for various banana cultivars. The first category had stalk weight < 1.20 kg. for Hindi and Basrai cultivars. The second one differed from 1.21 to 1.37 kg. for Ambel , Williams , Poyo , and Maghrabi cultivars. The third level was > 1.38 kg. for Mohamed Ali , Paradica , and Sindihi cultivars.

Varietal differences in the stalk weight of bunch for different banana cultivars could be matched through different related papers are similar to the findings obtained by **Behairy (1968) , Holder and Gumbs (1983 - a) and Abd El-Naby (1988).**

4-III.1.4. Stalk percentage :

Stalk percentage is shown in **Table (10)** and **Fig. (8)** which declared that banana cultivars varied in their values of stalk percentage from 4.91 for Williams to 14.56 for Ambel cultivar. Other cultivars had intermediate values. By all means , statistical analysis pointed out that differences between Hindi , Basrai , Poyo , and Maghrabi , between Basrai , Williams , Poyo and Maghrabi cultivars , between Paradica and Sindihi , between Paradica and

Mohamed Ali were so small to reach the significant level. However , Ambel cultivar showed significant difference as compared with other cultivars.

In addition , banana cultivars under study could be arranged under three levels as stalk percentage was concerned. The first level falls < 8.10 % which covered the majority of banana cultivars i. e. Hindi , Basrai , Williams , Poyo , Maghrabi and Sindihi. The second one varied from 8.11 to 11.33 % for Paradica , Mohamed Ali cultivars. The third group exceeding 11.34 % which resembled Ambel cultivar.

The available literature of stalk percentage was mentioned by **Behairy (1968) , Holder and Gumbs (1983-a) and Abd El-Naby (1988) which confirmed our results.**

4-III.1.5 Number of hands per bunch :

It is clear from **Table (11)** that Mohamed Ali banana cultivar had the highest number of hands per bunch (13.6) whilist Sindihi gave the lowest number (9.6). Other cultivars studied were intermediate in this respect. However , no significant differences were noticed between Hindi , Paradica , and Sindihi , between Basrai , Poyo , and Ambel , between Williams and Maghrabi cultivars. On the contrary , differences between Williams , Mohamed Ali and Sindihi cultivars were significant .

Moreover , banana cultivars lied under three ranges of hands number per bunch. The first range was below 11 for Sindihi , Hindi , Basrai , Paradica , and Ambel cultivars. The second range from 11 to

Table (11) : Number of hands and fingers per bunch of different banana cultivars (1985/1986 and 1986/1987 seasons).

Cultivar	Hands number per bunch.			Fingers number per bunch.		
	85/86	86/87	Average	85/86	86/87	Average
Hindi	10.00 a	9.60 a	9.80 ab	193.80 bcd	193.20 c	193.50 c
Basrai	10.70 b	10.50 b	10.60 cd	197.40 bcd	197.20 cd	197.30 c
Williams	12.00 c	12.20 c	12.10 f	205.50 cd	205.50 d	205.50 cd
Poyo	11.20 b	11.40 c	11.30 de	199.90 bcd	200.20 cd	200.05 c
Maghrabi	11.60 b	11.80 c	11.70 ef	218.90 de	219.40 e	219.15 d
Paradica	10.30 a	10.30 ab	10.30 abc	174.10 abc	175.10 b	174.60 b
Ambel	10.70 b	10.50 ab	10.60 bcd	169.80 ab	134.00 a	151.90 a
Mohamed Ali	13.50 b	13.60 d	13.55 j	240.50 e	242.20 f	241.35 e
Sindihi	9.40 a	9.80 ab	9.60 a	138.00 a	133.60 a	135.80 a

Means followed by same letter (s), within each column, are not significantly different from each other at 5 % level.

12 for Williams , Poyo , Maghrabi. Lastly , the third group exceeded 12 which covered Mohamed Ali cultivar.

Moreover , these findings coincided with those found by **Smirin (1960) , Sanchez Nieva and others (1970) , Walker (1970) , Swidan (1972) , Lassoudier (1974) , Shawky et al (1974) , Alagiamanavalan et al (1975) , Ibrahim et al (1976) , Ito and Atubra (1977) , Holder and Gumbs (1982) , Samson (1982) , Robinson (1982) , Robinson and Nel (1985), Abou-Aziz et al (1987 - a and b) , Mayaz (1987) , Tadros et al (1987).**

4-III.1.6. Number of fingers per bunch :

It is quite evident from **Table (11)** that there was a good relation between hands number per bunch and number of fingers per bunch. Thus , as hands number per bunch increased , fingers number increased , simultaneously. Moreover , data indicated that banana cultivars differed in their values. Consequently , the highest value (241.4) was noticed for Mohamed Ali cultivar whereas Sindihi had the lowest value (135.8) in this respect. Anyhow , values of other cultivars were in between .

In regard to the statistical analysis , it is well noticed that differences between Hindi , Basrai , Williams , and Poyo , between Williams and Maghrabi , between Ambel and Sindihi cultivars were so small to reach the significant level. Adversely , significant differences were remarkably noticed between Mohamed Ali , Ambel, Paradica , and Maghrabi cultivars.

Furthermore , three groups were clearly observed as number of fingers per bunch was concerned. The first group with less than 171 fingers for Sindihi and Ambel cultivars. Beside , the second range was from 171.1 to 206.2 for most banana cultivars under study i.e. Paradica , Hindi , Basrai , Williams , and Poyo. The third class covered Maghrabi and Mohamed Ali with > 206.2 fingers / bunch.

These findings are in harmony with those of **Youssef (1968) . Malik and Ahmed (1972) . Lassoudiere (1974) . Shawky et al (1974) , Ibrahim et al (1976) , Abd El-Kader (1979) , Holder and Gumbs (1982), Abou-Aziz et al (1987 - a and b). Tadros (1987) , and Abd El-Naby (1988).**

4-III.2. Hand parameters :

4-III.2.1. Hand weight :

Data presented in **Table (12)** and graphically illustrated in **Fig. (9)** pointed out that banana cultivars varied in hand weight. Consequently , the heaviest cultivar (2.00 Kg.) was Williams whilist the lightest one (0.75 Kg.) was Ambel cultivar. Other cultivars were scattered between these two extremes. By all means , Basrai , Poyo , and Maghrabi cultivars were more or less statistically similar in their values. The same trend was noticed between Williams and Sindihi , and between Basrai and Paradica cultivars. On the other hand , Hindi , Williams , Paradica , Ambel , and Mohamed Ali cultivars showed significant differences.

Table (12) : Hand weight and fingers number per hand of different banana cultivars (1985/1986 and 1986/1987 seasons).

Cultivar	Hand weight (kg.)			Fingers number / hand		
	85/86	86/87	Average	85/86	86/87	Average
Hindi	1.41 c	1.39 b	1.40 c	18.50 c	20.10 e	19.30 c
Basrai	1.71 cd	1.59 cd	1.65 de	18.40 bc	18.80 d	18.60 bc
Williams	2.10 e	1.90 f	2.00 f	17.10 abc	17.00 b	17.05 abc
Poyo	1.87 de	1.69 de	1.78 e	17.70 bc	17.50 bc	17.60 abc
Maghrabi	1.86 de	1.64 de	1.75 de	19.00 c	18.40 d	18.70 bc
Paradica	1.73 cd	1.47 bc	1.60 d	17.00 abc	17.10 b	17.05 abc
Ambel	0.68 a	0.82 a	0.75 a	15.80 ab	14.80 a	15.30 ab
Mohamed Ali	1.02 b	0.94 a	0.98 b	17.80 bc	17.80 c	17.80 bc
Sindihi	2.04 e	1.76 e	1.90 f	14.80 a	13.70 a	14.25 a

Means followed by same letter (s), within each column, are not significantly different from each other at 5 % level.

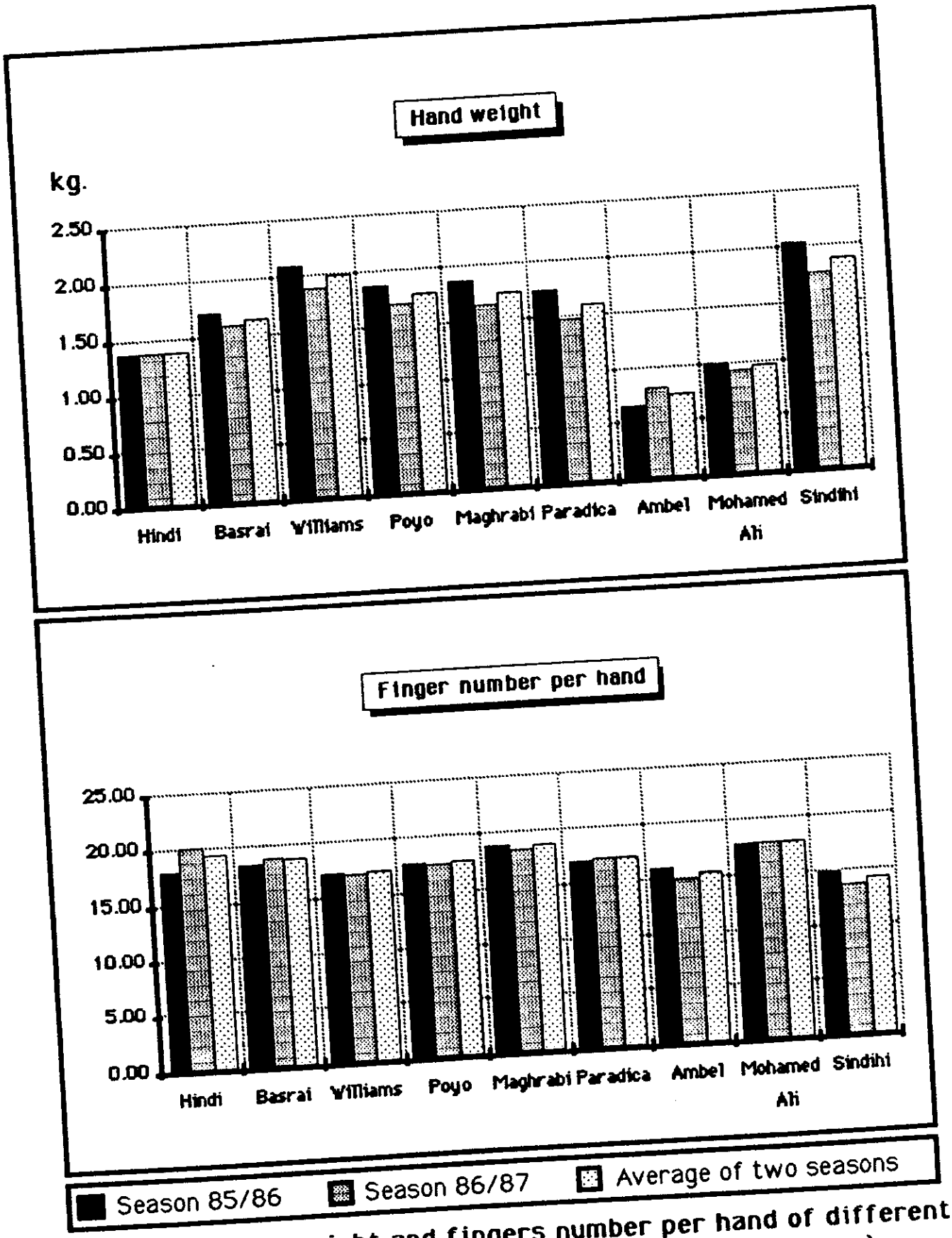

Fig. (9) : Hand weight and fingers number per hand of different banana cultivars (1985/1986 and 1986/1987 seasons).

Moreover , banana cultivars belonged to three levels of hand weight. Thus , the first level was < 1.16 Kg. for Ambel and Mohamed Ali cultivars. The second range was from 1.17 - 1.59 Kg. which included Hindi cultivar. The third class was > 1.60 Kg. for Paradica , Basrai , Maghrabi , Poyo , Sindihi and Williams cultivars.

Anyhow , hand weight in this study was similar with the findings of **Shawky et al (1974) and Saad (1979).**

4-III.2.2. Fingers number per hand :

Data presented in **Table (12)** and **Fig. (9)** clearly declare that banana cultivars varied in values of fingers number per hand. The highest value was noticed for Mohamed Ali while Sindihi cultivar gave opposite trend in this sphere. Nevertheless , no significant differences were observed between Basrai , Williams , Poyo , Maghrabi , Paradica , Ambel , and Mohamed Ali , between Hindi , Basrai , Williams , Poyo , Maghrabi and Paradica , and between Williams , Poyo , Paradica , Ambel and Sindihi cultivars. On the other hand , differences between Hindi and Sindihi cultivars ever so little were statistically significant.

Furthermore , values of fingers number per hand showed three ranges. The first range was < 16 fingers for Sindihi and Ambel cultivars. Beside , the second level differed from 16 to 17.6 for Williams , Poyo , and Paradica cultivars. The third level was > 17.7 which covered Mohamed Ali , Basrai , Maghrabi , and Hindi cultivars.

The varietal differences which were evident in this study are similar to those mentioned by **Malik and Ahmed (1972) . Ibrahim et al (1976) . Abd El-Kader (1979) . Robinson and Nel (1985) and Mayaz (1987) .**

4-III.3. Fruit quality :

4-III.3.1. Fruit physical properties :

4-III.3.1.1. Finger length :

It is obvious from **Table (13)** that finger length differed from one cultivar to another. Thus , the shortest finger was noticed for Mohamed Ali (9.9 cm.) while the longest finger for Williams (20.2 cm.). Other cultivars lied in intermediate place.

Referring to statistical analysis , data pointed out that significant difference between Hindi and Sindihi cultivars was almost abscent. In contrast , differences between other cultivars under study ever so little were significant.

In the meantime , banana cultivars divided into three ranges in this respect. The first one with fingers length below 13.3 cm. for Mohamed Ali , Ambel , and Paradica (shortest finger banana cultivars). The second range from 13.3 to 16.8 cm. for Hindi , Basrai, and Sindihi cultivars. The third class > 16.8 cm. for Williams , Poyo , and Maghrabi cultivars.

Table (13) : Length , diameter and pedicel length of finger of different banana cultivars (1985/1986 and 1986/1987 seasons).

Cultivar	Finger length (cm.)			Finger diameter (cm.)			Pedicel length of finger (cm.)		
	85/86	86/87	Average	85/86	86/87	Average	85/86	86/87	Average
Hindi	14.90 d	14.70 d	14.80 d	3.28 b	3.32 b	3.30 b	2.25 ab	2.25 a	2.25 a
Basrai	15.70 d	15.90 e	15.80 e	3.35 b	3.45 bc	3.40 b	2.23 a	2.36 ab	2.30 a
Williams	19.90 f	20.50 j	20.20 h	3.94 c	3.94 d	3.94 c	2.70 cd	2.53 b	2.62 c
Poyo	18.20 e	18.40 f	18.30 j	3.38 b	3.44 bc	3.41 b	2.65 bcd	2.55 b	2.60 bc
Maghrabi	17.70 e	17.70 f	17.70 f	3.45 b	3.50 c	3.48 b	2.63 abcd	2.55 b	2.59 bc
Paradica	13.10 c	13.40 c	13.25 c	3.90 c	3.86 d	3.88 c	2.35 abc	2.41 ab	2.38 ab
Ambel	10.80 b	10.80 b	10.80 b	3.53 b	3.29 b	3.41 b	3.30 e	3.68 c	3.49 d
Mohamed Ali	9.80 a	10.00 a	9.90 a	2.93 a	2.89 a	2.91 a	2.78 d	2.63 b	2.71 c
Sindihi	15.00 d	15.20 d	15.10 d	4.55 d	4.65 e	4.60 d	4.50 f	4.58 d	4.54 e

Means followed by same letter (s), within each column, are not significantly different from each other at 5 % level.

These results go in line with the findings of **Ramaswamy and Muthukrishman (1973) . Alagiamanavalan et al (1975) . Ibrahim et al (1976) . Abd El-Kader (1979) . Tripathi et al (1981) . Robinson and Nel (1985) . and Mayaz (1987).**

4-III.3.1.2. Finger diameter :

Data presented in **Table (13)** declare that banana cultivars varied in their values of finger diameter. However , no significant differences were noticed between Hindi , Basrai , Poyo , Maghrabi and Ambel cultivars , between Williams and Paradica cultivars. In spite of that , differences between Williams and Poyo or Maghrabi, between Paradica , Ambel , Mohamed Ali , and Sindihi cultivars even so small were significant. Beside , the least cultivar in finger diameter value was Mohamed Ali whilist Sindihi cultivar took the other way around. Other cultivars studied had intermediate place.

By all means , banana cultivars seemed to be divided into three levels in this respect. The first level ranged below 3.47 cm. for the majority of cultivars i.e. Mohamed Ali , Ambel , Poyo , Hindi , and Basrai. The second range from 3.48 to 4.04 cm. for Williams , Maghrabi , and Paradica. Lastly , the third group was higher than 4.05 cm. for Sindihi cultivar only.

These results coincided with the findings of **Ramaswamy and Muthukrishman (1973) . Ibrahim et al (1976). Abd El-Kader (1979) , Tripathi et al (1981) , and Mayaz (1987).**

4-III.3.1.3. Pedicel length of finger :

It is well noticed from **Table (13)** that Hindi cultivar had fingers with shortest pedicel (2.25 cm.) whereas Sindihi cultivar was the longest one in this respect (4.54 cm.). Anyway , other cultivars under study scattered in their values between these two extremes.

In regard to statistical analysis , it is clear that Williams , Poyo , Maghrabi , and Mohamed Ali cultivars were more or less similar in their values from the statistical point of view. Similarly , significant differences were disappeared between Hindi , Basrai and Paradica , between Poyo and Maghrabi cultivars. Nevertheless , differences between Paradica , Ambel , Mohamed Ali and Sindihi cultivar ever so little were significant.

Moreover , three ranges of pedicel length of finger could put in account. The first range was < 3.01 cm. for most banana cultivars studied i.e. Hindi , Basrai , Williams , Poyo , Maghrabi , Paradica and Mohamed Ali. The second one from 3.02 - 3.78 cm. for Ambel cultivar. In last , the third group was > 3.80 cm. for Sindihi cultivar.

4-III.3.1.4. Finger curvature :

a- Outer row :

It is obvious from **Table (14)** that outer row of banana cultivars varied in finger curvature from 1.06 for Sindihi cultivar to 1.58 for Maghrabi. Other cultivars studied lied in intermediate place. However , significant differences between Williams , Poyo ,

Teble (14) : Finger curvature of different banana cultivars (1985/1986 and 1986/1987 seasons.)

Cultivar	Outer row			Inner row		
	85/86	86/87	Average	85/86	86/87	Average
Hindi	1.48 cde	1.37 cd	1.43 d	1.31 cd	1.20 bc	1.26 c
Basrai	1.50 de	1.39 cd	1.45 d	1.36 de	1.27 cd	1.32 d
Williams	1.64 f	1.46 de	1.55 e	1.40 e	1.31 de	1.36 b
Poyo	1.56 ef	1.53 ef	1.55 e	1.36 de	1.36 e	1.36 e
Meghrabi	1.60 ef	1.57 f	1.59 e	1.37 de	1.32 de	1.35 de
Paradica	1.36 bc	1.34 c	1.35 c	1.14 ab	1.11 ab	1.13 b
Ambei	1.38 bcd	1.16 b	1.27 b	1.14 ab	1.10 a	1.12 b
Mohamed Ali	1.29 b	1.30 c	1.30 b	1.23 bc	1.21 c	1.22 c
Sindihi	1.07 a	1.05 a	1.06 a	1.05 a	1.03 a	1.04 a

Means followed by same letter (s), within each column, are not significantly different from each other at 5 % level.

and Maghrabi , between Hindi and Basrai , and between Ambel and Mohamed Ali cultivars were lacking. In contrast , differences between Sindihi , Ambel , Paradica , Williams , and Hindi ever so little were almost significant.

b- Inner row :

Finger curvature of inner row of different cultivars is presented in **Table (14).** It is quite evident that banana cultivars varied obviously from 1.04 for Sindihi to 1.36 for both Williams and Poyo cultivars. Other cultivars studied were in between in their values. However , no significant differences were noticed between Williams , Poyo , and Maghrabi cultivars , between Hindi and Mohamed Ali , between Basrai and Maghrabi. Nevertheless , significant difference was appeared between Sindihi , Mohamed Ali , Ambel , Williams and Basrai banana cultivars.

These results are in agreement with that reported by **Baghdadi and Keleg (1966) , and Holder and Gumbs (1983- a).**

4-III.3.1.5. Finger weight :

As shown in **Table (15)** and **Fig. (10)** data clearly indicated that banana cultivars varied in their values of finger weight. In this sphere , the heaviest cultivar (127.3 g.) was Sindihi while the lightest one (49.2) was Mohamed Ali. By all means , other cultivars under study lied in between.

Table (15) : Finger weight , pulp weight , pulp percentage and peel thickness of different banana cultivars (1985/1986 and 1986/1987 seasons).

Cultivar	Finger weight (gm.)			Pulp weight (gm.)			Pulp percentage			Peel thickness (mm.)		
	85/86	86/87	Average	85/86	86/87	Average	85/86	86/87	Average	85/86	86/87	Average
Hindi	67.90 b	68.70 b	68.30 bc	40.80 ab	40.80 a	40.80 a	60.10 a	59.40 a	59.75 a	2.30 e	1.90 d	2.10 d
Basrai	71.60 b	83.40 c	77.50 cd	45.30 bc	51.30 b	48.30 b	63.30 ab	61.50 ab	62.40 ab	2.20 de	2.00 de	2.10 d
Williams	122.70 d	112.70 f	117.70 f	86.40 j	83.10 e	84.75 e	70.40 cd	73.70 cd	72.05 e	2.20 de	2.40 fj	2.30 e
Poyo	95.30 c	95.50 e	95.40 e	63.20 de	61.80 c	62.50 c	66.30 bc	64.70 bc	65.50 bc	1.90 d	2.10 de	2.00 d
Maghrabi	95.70 c	89.70 d	92.70 e	63.80 e	62.30 c	63.05 c	66.70 bc	69.50 c	68.10 cd	2.00 de	2.20 ef	2.10 d
Paradica	95.10 c	81.80 c	88.45 de	72.10 ef	62.50 c	67.30 c	75.80 e	76.40 d	76.10 f	1.60 c	1.60 c	1.60 c
Ambel	63.80 b	56.30 a	60.05 ab	53.50 cd	44.90 a	49.20 b	83.90 f	79.80 e	81.85 j	0.80 a	0.80 a	0.80 a
Mohamed Ali	46.10 a	52.20 a	49.15 a	34.50 a	40.40 a	37.45 a	74.80 de	77.40 d	76.10 f	1.20 b	1.20 b	1.20 b
Sindihi	126.90 d	127.70 j	127.30 f	79.70 fj	81.10 d	80.40 d	62.80 ab	63.50 ab	63.15 ab	2.60 f	2.60 j	2.60 f

Means followed by same letter (s), within each column, are not significantly different from each other at 5 % level.

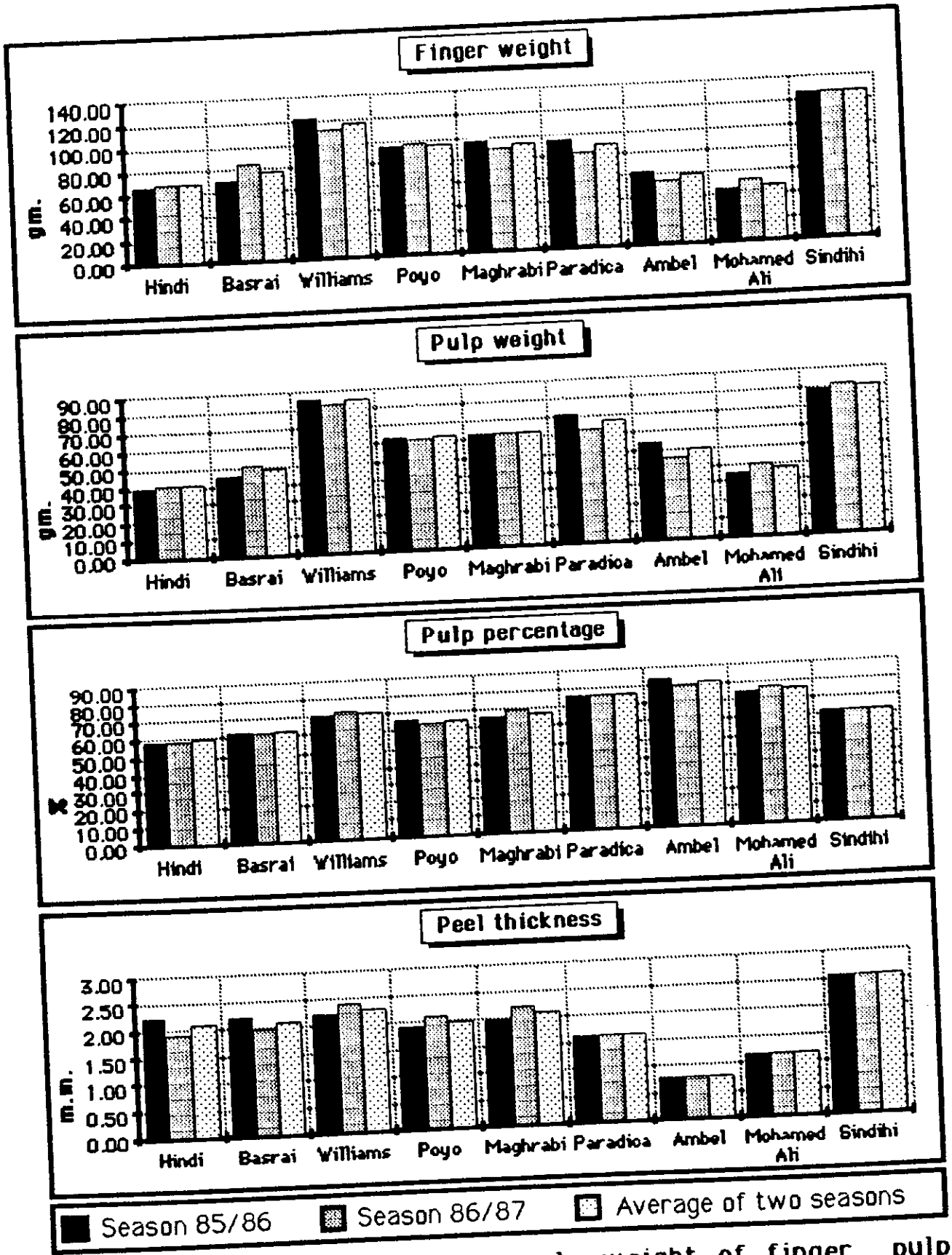

Fig. (10): Finger weight , pulp weight of finger , pulp percentage and peel thickness of different banana cultivars (1985/1986 and 1986/1987 seasons).

Regarding statistical analysis , it is quite evident that significant differences between Poyo , Maghrabi , and Paradica , between Ambel and Mohamed Ali , between Williams and Sindihi , between Hindi and Ambel and between Basrai and Paradica were almost abscent. On the other hand , Williams , Hindi , Poyo , and Mohamed Ali values were statistically significant.

Furthermore , banana cultivars could be arranged in three ranges. The first one was < 75 g. for Mohamed Ali , Ambel and Hindi. The second level was from 75 to 101 g. for Basrai , Poyo , Maghrabi , and Paradica cultivars. In last , the third group was > 101 g. That was true for Williams , and Sindihi cultivars.

These findings confirmed the results obtained by **Sanchez Nieva and others (1970) , Ibrahim et al (1976) , Abd El-Kader (1976 and 1986) , Tripathi et al (1981) , Azhakiamanavalan et al (1984) , Robinson and Nel (1985) , and Mayaz (1987)**

4-III.3.1.6. Pulp weight :

Data presented in **Table (15)** and **Fig. (10)** declared that banana cultivars under study had values varied in pulp weight. In this concern, the lowest value 37.5 g. was noticed for Mohamed Ali cultivar while the highest value 84.8 g. was for Williams. Anyhow , other cultivars had values between these two extremes. In addition , differences between Poyo , Maghrabi and Paradica , between Hindi and Mohamed Ali , and between Basrai and Ambel cultivars were

statistically insignificant. In contrast , differences between Williams , Basrai , Hindi , Poyo , and Sindihi cultivars were significant.

Meanwhile , values of banana cultivars were in three categories. The first category was < 53 g. for mohamed Ali , Ambel , Hindi , and Basrai. The second group was from 53 to 69 g. which covered Poyo , Maghrabi , and Paradica. The third level was > 69 g. for Williams and Sindihi cultivars.

These results are similar to those concluded by **Salem et al (1976) , and Abd El-Kader (1979).**

4-III.3.1.7. Pulp percentage :

Data tabulated in **Table (15)** and illustrated in **Fig. (10)** showed that pulp percentage of banana cultivars varied from 59.8 for Hindi to 81.9 for Ambel cultivar. Other cultivars lied in between.

Concerning the statistical analysis , it is obvious that differences between Hindi , Basrai , and Sindihi , between Basrai , Sindihi and Poyo , between Poyo and Maghrabi , and between Paradica and Mohamed Ali were lacking from significancy. On the other hand , Mohamed Ali , Ambel , Maghrabi , Williams , and Hindi cultivars had values varied significantly.

Meanwhile , banana cultivars under study could be classified , as pulp percentage was concerned , into three categories. The lowest range was < 67 % for Hindi , Basrai , Sindihi , and Poyo cultivars. The second level was from 67 to 74 % for Maghrabi , and Williams cultivars. The last range was > 74 % for Paradica , Ambel , and Mohamed Ali cultivars.

These results are confirmed with those concluded by **Ito and Atubra (1977) and Holder and Gumbs (1983 - a).**

4-III.3.2. Chemical properties :

4-III.3.2.1. Sugars and starch :

4-III.3.2.1.1. Total sugars :

As shown in **Table (17)** it is interesting to notice that fruits of various banana cultivars differed in their values of total sugars. The highest amount (19.65 %) existed in Maghrabi fruits while the lowest value (11.25 %) was noticed for Sindihi cultivar. Other cultivars had values in between , in this concern.

Considering statistical analysis , it is clear that difference between Hindi and Basrai cultivars was far away from significancy. Moreover , other cultivars showed significant differences.

At all events , banana cultivars under study indicated three levels of fruit total sugars. The first level was < 14 % for Sindihi and Paradica cultivars (low sweetness cultivars). The second group from 14 to 17 % for Ambel , Mohamed Ali , Hindi , and Basrai (intermediate sweetness cultivars). The third level > 17 % for Williams , Poyo , and Maghrabi (highly sweet cultivars).

As to the related reports on banana , records of the total sugars within ripe fruit pulp appeared to be a matter of a wide range of varietal variabilities between extremes of 15 - 28 % in different banana cultivars (**Von - Loesecke , 1950 ; Wardlaw , 1972 ;**

Mohamed Ali cultivars were so small to reach the significant level. Adversely , Hindi , Basrai , Williams , Poyo , Maghrabi , Paradica , and Ambel cultivars gave values with significant differences.

These results were in agreement with that concluded by **Ito and Atubra (1977) , and Holder and Gumbs (1983 - a).**

4-III.3.1.10. Finger firmness :

Data of finger firmness presented in **Table (16)** and **Fig. (11)** declare that banana cultivars varied from 16.5 (Lb / $inch^2$) for Mohamed Ali (the softest cultivar) to 26.6 (Lb / $inch^2$) for Williams (the hardest cultivar). Other cultivars had values in between.

Considering statistical analyis , data indicated that values of different banana cultivars except Ambel and Mohamed Ali cultivars were significantly different.

These results are in conjunction with that reported by **Ito and Atubra (1977) , and Holder and Gumbs (1983 - a).**

4-III.3.1.11. Pulp firmness :

Pulp firmness values are persented in **Table (16)** and **Fig. (11).** The lowest value (5.8) was noticed for Mohamed Ali while the highest one (13.5) was for Williams cultivar. Other cultivars studied were in between in this respect. However , significant difference between Hindi and Paradica cultivars was abscent. On the other hand , the differences between other cultivars were significant.

These results were in agreement with that concluded by **Salem et al (1976) , and Abd El-Kader (1979).**

4-III.3.1.8. Peel thickness :

Peel thickness of various banana cultivars under study fluctuated from 0.8 mm. for Ambel to 2.6 mm. for Sindihi , **Table (15)** and **Fig. (10).** Anyhow , other cultivars lied between these two extremes. In addition , no significant difference was noticed between Hindi , Basrai , poyo and Maghrabi cultivars. On the other hand , differences between other cultivars were so high to reach the significant level.

In regard to range levels of cultivars in this sphere , it is quite evident that banana cultivars lied under three levels. The first one (thinnest peel cultivars) was < 1.4 mm. for Ambel , and Mohamed Ali cultivars. The second range varied from 1.4 to 2.0 mm. for Paradica. In last , the third group (thickest peel cultivars) was > 2 mm. which covered all other cultivars under study. The same trend was found by **Abd El-Kader (1979).**

4-III.3.1.9. Finger Hardiness :

Finger hardiness of various banana cultivars is shown in **Table (16)** and graphically illustrated in **Fig. (11).** Data clearly indicated that values of finger hardiness varied from 38.1 kg. for Mohamed Ali to 54.0 kg. for Williams. By all means , other cultivars studied were intermediate in their values.

Referring to statistical analysis , it is found that differences between Hindi , Paradica , and Sindihi , and between Ambel and

Table (16) : Finger hardiness , firmness and pulp firmness of different banana cultivars (1985/1986 and 1986/1987 seasons).

Cultivar	Finger hardiness * (kg)			Finger firmness ** (L / inch^2)			Pulp firmness (L / inch^2)		
	85/86	86/87	Average	85/86	86/87	Average	85/86	86/87	Average
Hindi	41.60 b	41.60 c	41.60 b	21.00 b	21.30 d	21.15 d	8.90 c	9.50 cd	9.20 cd
Basrai	45.30 c	45.90 d	45.60 c	23.70 c	23.90 e	23.80 e	10.60 e	10.90 de	10.75 e
Williams	53.60 f	54.30 j	53.95 f	26.30 d	26.90 f	26.60 h	12.90 j	14.00 f	13.45 j
Poyo	50.70 e	51.90 f	51.30 e	25.30 cd	25.70 ef	25.50 j	12.10 fj	12.30 e	12.20 f
Meghrabi	48.30 d	48.40 e	48.35 d	24.90 cd	24.60 e	24.75 f	11.80 f	12.10 e	11.95 f
Paradica	42.10 b	40.60 bc	41.35 b	20.60 b	19.00 c	19.80 c	10.30 de	8.90 bc	9.60 d
Ambel	39.70 a	38.60 ab	39.15 a	17.50 a	16.90 ab	17.20 a	9.20 cd	8.00 bc	8.60 c
Mohamed Ali	38.70 a	37.50 a	38.10 a	16.70 a	16.30 a	16.50 a	5.50 a	6.00 a	5.75 a
Sindihi	41.50 b	41.00 bc	41.25 b	18.10 a	18.7 bc	18.40 b	6.80 b	7.70 ab	7.25 b

* (El Mahdi , 1960 and El-Behairy , 1983).
** It was determined using hand pressure tester (Balluf pressure tester - MEG Co.).
Means followed by same letter (s), within each column, are not significantly different from each other at 5 % level.

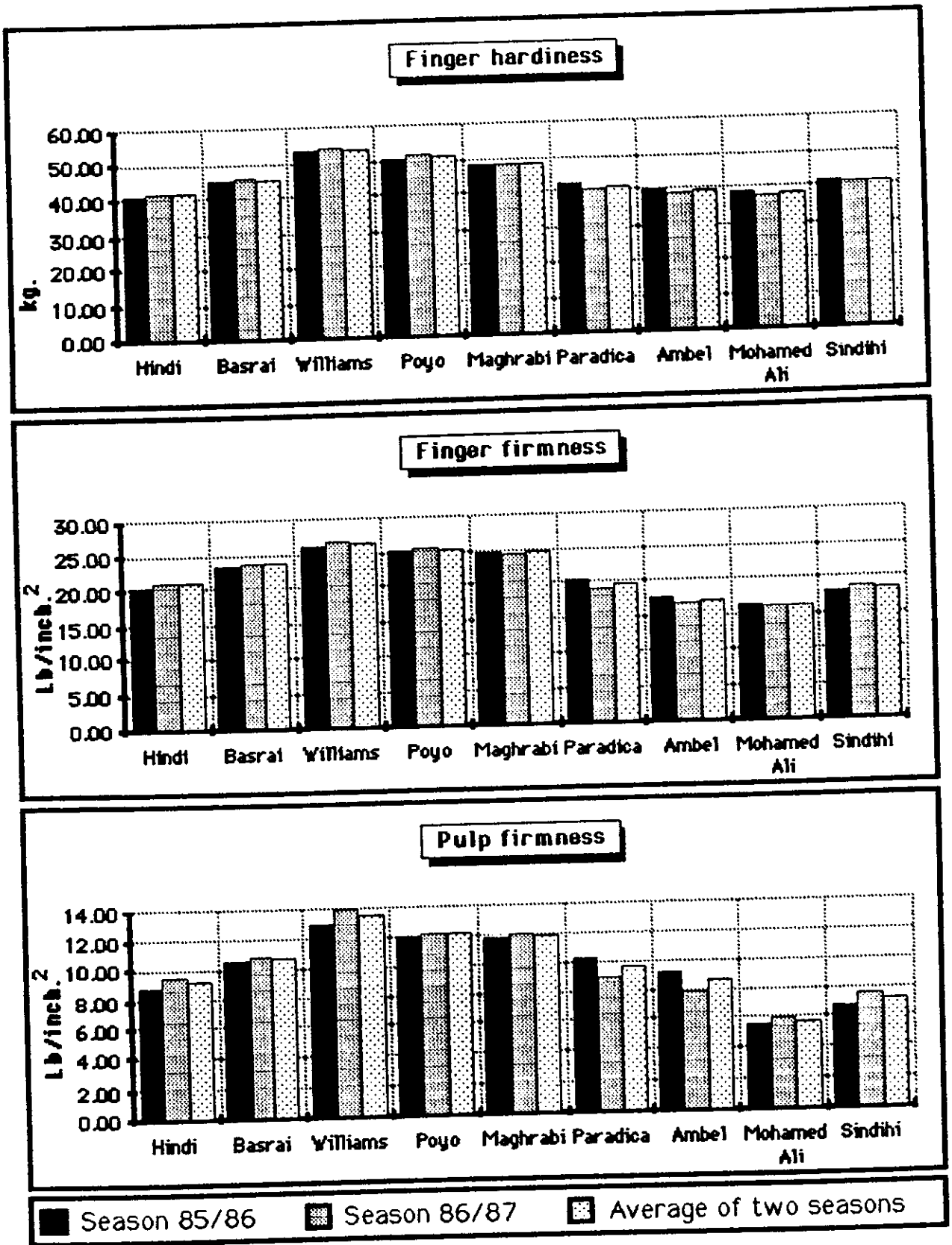

Fig. (11): Finger hardiness, firmness and pulp firmness of different banana cultivars (1985/1986 and 1986/1987 seasons).

ble (19) : Dry matter percentages of leaf ; pseudostem ; corm at bunch shooting and ripe pulp of different banana cultivars (1985/1986 and 1986/1987 seasons).

Cultivar	Leaf			Pseudostem			Corm			Ripe pulp		
	85/86	86/87	Average	85/86	86/87	Average	85/86	86/87	Average	85/86	86/87	Average
Hindi	25.00 ab	24.26 a	24.63 ab	8.42 d	7.84 c	8.13 de	16.30 d	16.22 de	16.26 d	27.40 a	27.30 b	27.35 ab
Basrai	22.98 a	25.65 a	24.32 a	8.65 de	8.05 cd	8.35 ef	16.48 de	16.34 e	16.41 d	28.30 a	27.90 bc	28.10 bc
Williams	30.90 de	29.68 c	30.29 c	8.75 de	8.55 e	8.65 j	16.75 e	16.33 de	16.54 d	28.70 a	31.70 d	30.20 d
Poyo	25.64 ab	26.00 a	25.82 ab	8.90 ef	8.26 de	8.58 fj	17.35 f	16.57 e	16.96 e	29.30 a	28.90 c	29.10 d
Maghrabi	29.90 cd	29.26 c	29.58 c	9.24 f	9.00 f	9.12 h	18.28 j	18.06 f	18.17 f	28.70 a	28.10 bc	28.40 bc
Paradica	33.40 ef	28.78 bc	31.09 cd	7.83 c	8.07 cd	7.95 cd	13.80 c	13.96 c	13.88 c	27.90 a	27.10 b	27.50 abc
Ambel	35.48 f	29.50 c	32.49 d	4.85 a	5.07 a	4.96 a	9.58 a	9.88 a	9.73 a	35.80 b	33.70 e	34.75 e
Mohamed Ali	27.12 bc	26.28 ab	26.70 b	6.53 b	6.95 b	6.74 b	10.10 b	10.34 b	10.22 b	26.80 a	25.60 a	26.20 a
Sindihi	33.38 ef	29.20 c	31.29 cd	7.48 c	7.92 cd	7.70 c	9.50 a	9.54 a	9.52 a	35.20 b	32.10 d	33.65 e

Means followed by same letter (s), within each column, are not significantly different from each other at 5 % level.

Table (17) : Total sugars , reducing sugers , starch , total sugers/starch ratio and titratable acidity of different banana cultivars (1985/1986 and 1986/1987 seasons).

Cultivar	Total sugars (%)			Reducing sugars (%)			Srarch (%)			Total sugars/starch ratio			Titratable acidity (%)		
	85/86	86/87	Average	85/86	86/87	Average	85/86	86/87	Average	85/86	86/87	Average	85/86	86/87	Average
Hindi	16.73 e	16.98 e	16.86 e	6.70 e	6.73 c	6.72 d	2.40 b	2.60 a	2.50 b	6.97 e	6.54 e	6.76 e	0.58 b	0.58 b	0.58 c
Basrai	16.85 e	17.05 e	16.95 e	6.55 cd	6.70 c	6.63 c	2.30 a	2.58 a	2.44 a	7.37 f	6.64 e	7.01 f	0.57 b	0.57 b	0.57 c
Williams	18.68 f	18.83 f	18.76 f	7.68 f	7.80 e	7.74 e	2.45 b	2.60 a	2.53 c	7.64 f	7.24 f	7.44 j	0.38 a	0.41 a	0.40 a
Poyo	19.20 j	19.43 j	19.32 j	8.50 h	8.70 j	8.60 j	2.40 b	2.65 b	2.53 c	8.02 j	7.35 f	7.69 h	0.55 b	0.53 b	0.54 b
Maghrabi	19.60 h	19.70 h	19.65 h	7.95 j	8.15 f	8.05 f	2.45 b	2.55 a	2.50 b	8.02 j	7.74 j	7.88 i	0.39 a	0.40 a	0.40 a
Paradica	13.40 b	13.53 b	13.47 b	5.58 b	5.73 b	5.66 b	6.38 e	6.55 e	6.47 f	2.10 b	2.07 b	2.09 b	0.98 d	0.97 d	0.98 f
Ambei	15.38 c	15.50 c	15.44 c	6.50 c	6.70 c	6.60 c	4.43 d	4.58 d	4.51 e	3.48 c	3.39 c	3.44 c	0.80 c	0.81 c	0.81 d
Mohamed Ali	15.93 d	16.15 d	16.04 d	6.60 d	6.80 d	6.70 d	3.23 c	3.45 c	3.34 d	4.95 d	4.69 d	4.82 d	1.12 e	1.10 e	1.11 j
Sindihi	11.20 a	11.30 a	11.25 a	4.60 a	4.75 a	4.68 a	9.40 f	9.58 f	9.49 j	1.20 a	1.18 a	1.19 a	0.88 c	0.90 cd	0.89 e

Means followed by same letter (s), within each column, are not significantly different from each other at 5 % level.

Ketiku , 1976 ; Salem et al . 1976 ; Mariott et al . 1983 ; Chacôn et al , 1987 ; and Abd El-Naby , 1988).

4-III.3.2.1.2. Reducing sugars :

It is clear from **Table (17)** that banana cultivars studied varied in their values of reducing sugars. Thus , the lowest cultivar in this respect was Sindihi (4.68) whilist Poyo cultivar surpassed all other cultivars in fruit reducing sugars since its fruits contained 8.60 %.

Furthermore , no significant difference was observed between Hindi and Mohamed Ali as well as between Basrai and Ambel. Anyhow , differences between other cultivars were so high to be statistically significant.

Moreover , banana cultivars lied under three categories in this respect. The first one was < 6 % for Sindihi and Paradica cultivars. The second group was from 6 to 7.3 %. That was true for Ambel , Mohamed Ali , Basrai and Hindi cultivars. In last , the third level was > 7.4 % for Williams , Poyo , and Maghrabi cultivars.

Related reports , declared that reducing sugars of the ripe fruit pulp were of a wide range of consistent differences in the different banana cultivars **(Salem et al . 1976 ; and Chacôn et al . 1983).**

4-III.3.2.1.3. Starch :

It is interesting to notice from **Table (17)** that banana cultivars varied in their fruit starch content. On this base , Basrai

cultivar developed fruits less in starch (2.44). On the contrary , Sindihi cultivar gave an opposite trend in this respect (9.49). By all means , other cultivars were intermediate in their values.

So far as statictical analyis was concerned , data disclosed that significant difference was lacking between Williams and Poyo as well as between Hindi and Maghrabi cultivars. In contrast , differences between other cultivars were highly significant.

On the other hand , banana cultivars could be classified into two groups in this respect. The first group was below 6 % starch as for Hindi , Basrai , Williams , Poyo , Maghrabi , Ambel , and Mohamed Ali cultivars. The second class exceeded 6 % starch as for Paradica and Sindihi (Starchy cultivars).

The related banana literature with plantains (starchy cultivars) declared that the pulp of ripe fruit contained 3 to 12 % starch **(Mariott et al , 1963)**. Meanwhile , with different sweet banana cultivars , starch content of the ripe fruit was reported to vary between 0.82 and 2.9 % **(Von-Loesecke , 1950 ; Simmonds , 1966 ; Ketikue , 1976 ; Salem et al , 1976 ; Chacón et al , 1987 ; and Abd El-Naby , 1988)**.

4-III.3.2.1.4. Total sugars/starch ratio :

Table (17) declare that sugars / starch ratio differed from one banana cultivar to another. Thus , the lowest ratio (1.19) was noticed for Sindihi cultivar while the highest ratio (7.88) was remarked for Maghrabi cultivar. Anyhow , other cultivars studied

were in between. Moreover , different banana cultivars gave significant differences in this respect.

In addition , banana cultivars under study could be divided into three groups. The first one with sugar / starch ratio < 3 for Sindihi and Paradica. The second level was from 3.1 to 5.5 for Ambel and Mohamed Ali. The third range was > 5.6 which included the remaining banana cultivars i. e. Hindi , Basrai , Williams , Poyo , and Maghrabi cultivars.

The available reports did not regard the sugars / starch ratio for the ripe pulp of banana fruits.

4-III.3.2.2. Titratable acidity :

It is quite evident from **Table (17)** that banana cultivars varied in their acid content. Thus , the highest acidity (1.11 %) existed in fruits of Mohamed Ali while the lowest value (0.40 %) belonged to both Williams and Maghrabi fruits. Meanwhile , significant difference was lacking between Hindi and Basrai , as well as between Williams and Maghrabi cultivars. However , other cultivars studied gave remarkably significant differences.

Furthermore , banana cultivars belonged to three levels in fruit acidity. On this base , the first group was < 0.6 % for Williams , Maghrabi , Hindi , Basrai and Poyo. The second category was from 0.61 to 0.9 for Ambel and Sindihi. The third level was > 0.91 for Paradica , and Mohamed Ali (Acid cultivars).

This is in accordance with the findings of **Abou-Aziz et al (1970) , Bahgat (1974) , Salem et al (1976) , Abd El-Naby (1988) and Saleh (1988).**

4-III.3.2.3. Volatile constituents :

It is shown in **Table (18)** and **Fig. (12 - a , b and c)** that ethyl acetate is present in all banana cultivars except Mohamed Ali. The amount of ethyl acetate ranged from 0.69 % for Ambel cultivar to 30.75 % for poyo cultivar.

Beside , ethyl butyrate is noticed in all banana cultivars except both Hindi and Paradica cultivars. The highest amount of ethyl butyrate existed in Basrai cultivar (24.79 %) whilist the lowest amount was found in Poyo cultivar (1.71 %).

For all that , ethyl lactate appeared only in four cultivars i. e. Williams (4.97 %) , Sindihi (2.55 %) , Ambel (2.08 %) , and Hindi (1.87 %) but with relatively small amounts.

Furthermore , amyl acetate was identified in some cultivars i. e. Ambel , Sindihi , Poyo , Hindi , Paradica , Mohamed Ali. Anyway , Ambel cultivar contained the highest amount (5.77 %) while Mohamed Ali cultivar took the other way around in this respect (1.00 %).

In addition , amyl butyrate is present in all banana cultivars except Ambel and Poyo cultivars. Thus , the amount of amyl butyrate ranged from 2.79 % for Maghrabi to 46.40 % for Sindihi cultivar.

Table (18) : Volatile constituents percentage of different banana cultivars (season 1985/1986).

Peak No.	Retention time (minutes)	Volatile constituents percentage								
		Hindi	Basrai	Williams	Poyo	Maghrabi	Paradica	Ambel	Mohamed Ali	Sindihi
Ethyl acetate	1.3 - 1.8	5.61	3.31	4.58	30.75	3.72	2.21	0.69	-	1.39
Ethyl butyrate	2.5 - 2.8	-	24.79	11.92	1.71	12.29	-	23.07	8.70	11.91
unknown	3.3 - 3.7	19.65	4.96	-	7.12	3.26	17.64	-	-	-
Ethyl lactate	3.9 - 4.3	1.87	-	4.97	-	-	-	2.08	-	2.55
Unknown	4.8 - 5.3	2.81	7.44	4.97	1.07	7.26	3.53	-	23.20	-
Amyl acetate	5.5 - 6.0	1.97	-	-	2.56	-	1.85	5.77	1.00	4.64
Unknown	6.8	-	-	-	1.71	21.79	-	-	1.86	-
Amyl butyrate	7.5 - 8.3	20.58	14.88	22.92	-	2.79	19.40	-	9.86	46.40
Unknown	8.8 - 9.2	-	-	4.28	14.52	3.72	-	29.41	-	-
Unknown	9.5 - 10.8	2.25	6.20	7.64	1.42	-	1.41	-	-	-
Butyl acetate	11.2 - 11.8	4.21	3.31	-	-	14.90	-	6.34	23.20	1.24
Unknown	12.0 - 12.1	-	-	-	3.56	-	7.94	-	-	-
Butyl butyrate	13.8 - 14.8	13.10	-	14.97	17.79	6.98	-	4.15	2.78	8.51
Unknown	15.0 - 16.0	1.31	6.20	-	2.14	-	6.88	-	-	-
Ethyl valerate	16.5 - 17.8	5.61	9.92	4.58	7.12	5.59	-	20.76	10.44	7.73
Unknown	18.5	-	-	-	-	-	12.70	-	-	-
Amyl valerate	19.2 - 19.5	-	3.47	-	-	-	-	-	4.64	8.66
Unknown	20.6 - 21.3	7.02	5.62	5.73	-	9.31	7.94	3.11	-	-
Unknown	22.2	-	-	-	4.27	-	-	-	-	-
Unknown	23.5 - 23.8	14.03	-	-	-	-	18.52	4.61	-	-
Benzyl acetate	24.7 - 25.0	-	-	-	4.27	8.38	-	-	-	6.96
Unknown	26.0 - 26.5	-	-	13.45	-	-	-	-	15.31	-
Unknown	28.3	-	9.92	-	-	-	-	-	-	-

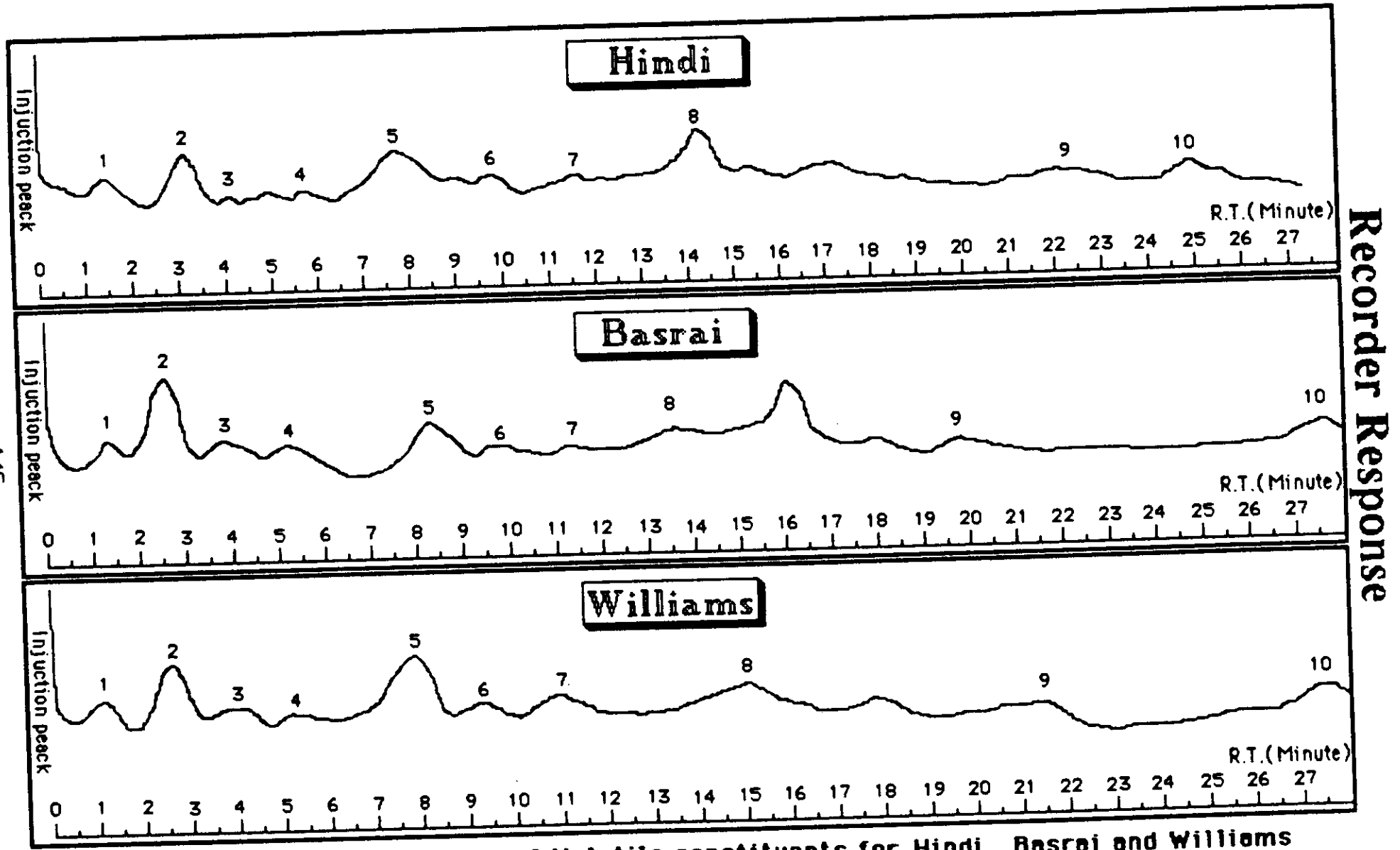

Fig. (12-a) : G L C chromatograms of Volatile constituents for Hindi , Basrai and Williams cultivars.

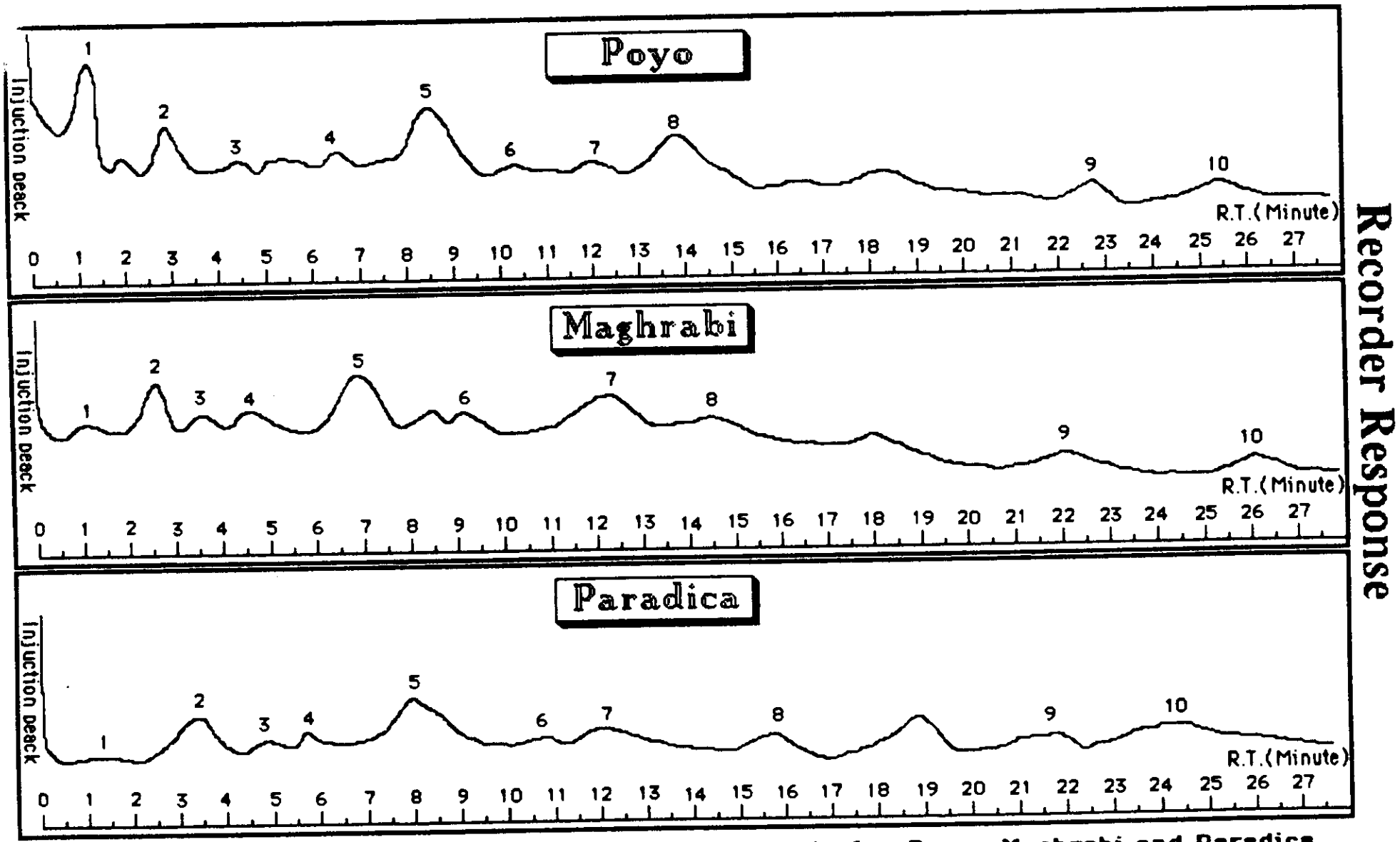

Fig. (12-b) : G L C chromatograms of Volatile constituents for Poyo , Maghrabi and Paradica cultivars.

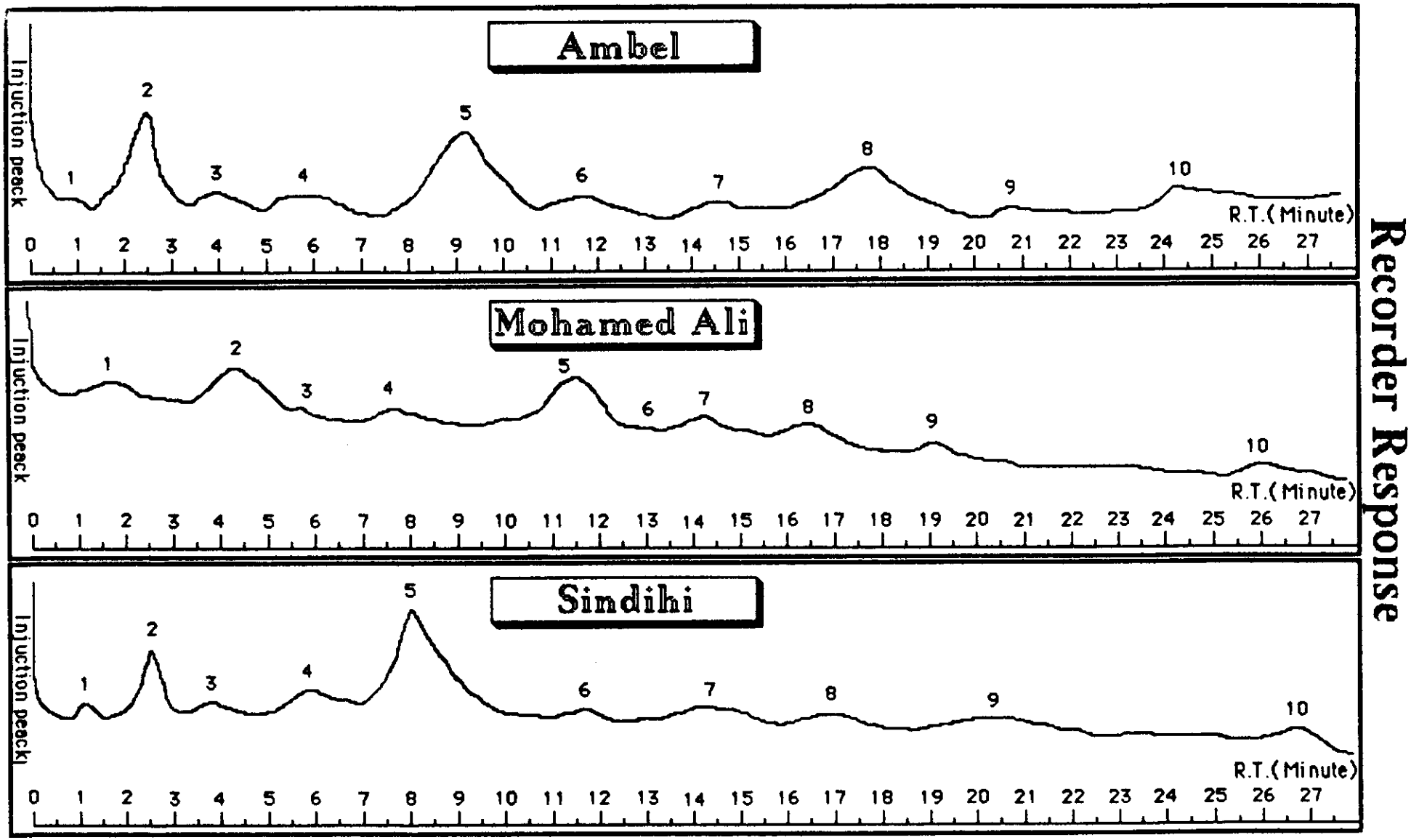

Fig. (12-c) : G L C chromatograms of Volatile constituents for Ambel, Mohamed Ali and Sindihi cultivars.

Unfortunately , Paradica , Williams and Poyo cultivars were void of butyl acetate whereas the reverse was true for the rest cultivars studied. In this concern , the amount of butyl acetate is between 1.24 % for Sindihi and 23.20 % for Mohamed Ali cultivar.

Regarding , butyl butyrate , data clearly indicated that it existed in all cultivars of banana regardless of Paradica and Basrai cultivars. In addition , it's amount ranged between 2.78 % for Mohamed Ali and 17.79 % for Poyo cultivar.

Moreover , all banana cultivars contained ethyl valerate except Paradica cultivar hence its amount ranged between 4.58 % for Williams and 20.76 % for Ambel cultivar.

Concerning Amyl Valerate , three cultivars of banana namely ; Basrai , Mohamed Ali , and Sindihi contained that volatile. However , the amounts of amyl valerate were 3.4711 , 4.6404 , and 8.6620 % for Basrai , Mohamed Ali , and Sindihi cultivars , respectively.

Lastly , Benzyl acetate appeared only in three cultivars i. e. Poyo (4.27 %) , Sindihi (6.96 %) , and Maghrabi (8.38 %).

Form the aforementioned data it is easy to conclude that Sindihi cultivar is the unique cultivar which contains the ten previous volatile components. On the other hand , Ambel , Mohamed Ali , Maghrabi , and Hindi cultivars contained only seven components. Williams , Basrai and Poyo cultivars contained only six components. By all means , Paradica cultivar was the poorest one in this respect hence it contained only three components. Anyhow , all cultivars studied contained other unknown components.

varied in their values in this respect. However , the highest value was observed for Maghrabi (9.12 %) while the lowest value was for Ambel cultivar (4.96 %). By all means , other cultivars had values in between. Concerning differences between cultivars , obtained results pointed out that significancy was abscent between Hindi and Basrai , between Williams and Poyo , between Hindi and Paradica , between Basrai and Poyo cultivars. In contrast , differences between Williams , Maghrabi , Ambel , Mohamed Ali and Sindihi cultivars were significant.

Meanwhile , banana cultivars had two ranges of pseudostem dry matter. In this respect , the first range was from 4.96 to 7.04 for Ambel and Mohamed Ali cultivars. The second group ranged from 7.05 to 9.12 for the rest cultivars under study.

These findings were confirmed with the results obtained by **Twyford and Walmsly (1973).**

4-IV.1.3. Corm :

It is clear from **Table (19)** that Ambel cultivar had corms with the lowest value of corm dry matter (9.73 %) while the reverse was true for Maghrabi cultivar where its corm dry matter was 18.17 %. Other cultivars lied in between. Anyway , significant differences between Hindi , Basrai , and Williams and between paradica and Mohamed Ali cultivars were lacking. On the other side , differences between other banana cultivars under study were significant.

However , banana cultivars lied under two groups as corm dry matter percentages were concerned. The first group varied from

9.52 to 13.84 for Ambel , Mohamed Ali and Sindihi cultivars. The second group was from 13.85 to 18.17 % . That was true for Paradica , Hindi , Basrai , Williams , Poyo and Maghrabi banana cultivars.

These results are in agreement with that reported by **Twyford and Walmsley (1973).**

4-IV.1.4. Ripe pulp :

Data of ripe pulp dry matter are presented in **Table (19).** It is quite evident that the highest value was noticed for Ambel while the lowest one was for Mohamed Ali cultivar. At all events , other values of banana cultivars lied between these two extremes.

Generally , obtained results clearly showed that the differences between Hindi , Basrai , Maghrabi , and Paradica ; between Williams and Poyo ; between Ambel and Sindihi ; and between Paradica and Mohamed Ali cultivars were so small to reach the significant level.

Furthermore , banana cultivars showed two levels of pulp dry matter. The first level was from 26.20 to 30.50 % for Hindi , Basrai , Williams , Poyo , Maghrabi , Paradica and Mohamed Ali cultivars. The second range was from 30.51 to 34.81 % . That was true for Ambel and Sindihi cultivars.

These results are in accordance with the findings of **Simmonds (1966) , Behairy (1968) , Salem et al (1976) , Samson (1982) and Abd El-Naby (1988).**

4-IV.2. Minerals Content :

4-IV.2.1. Ripe pulp :

Pulp minerals content are presented in **Table (20)**. It is clear that pulp nitrogen content varied obviously from one cultivar to another. Accordingly , the highest value was noticed for Sindihi while the lowest one was for Basrai cultivar. At all events , other banana cultivars were in between in their values.

Regarding statistical analysis for various banana cultivars , data showed that significant difference disappeared between Hindi and Basrai ; between Williams , Poyo , and Maghrabi ; between Maghrabi , Ambel and Mohamed Ali , as well as between Paradica and Sindihi cultivars.

Furthermore , banana cultivars under study indicated three groups in pulp nitrogen content. The first group with fruits contained nitrogen varied from 1.13 to 1.36 % for Hindi , Basrai , Williams and Poyo cultivars. The second range with intermediate values from 1.37 to 1.60 % for Maghrabi , Ambel , and Mohamed Ali cultivars. The last group differed from 1.61 to 1.84 % for Paradica and Sindihi cultivars.

Regarding the related reports , percentage of nitrogen was mentioned to vary between different cultivars from 0.5 to 2.84 % **(Von-Loesecke , 1950 ; Behairy , 1968 ; and Abd El-Kader , 1979).**

Referring to pulp phosphorus content , data clearly showed that banana cultivars were more or less similar in their values since no

Table (20) : Ripe pulp minerals content of different banana cultivars (1985/1986 and 1986/1987 seasons).

Cultivar	Element concentration in dry pulp (%)														
	N			P			K			Ca			Mg		
	85/86	86/87	Average	85/86	86/87	Average	85/86	86/87	Average	85/86	86/87	Average	85/86	86/87	Average
Hindi	1.19 ab	1.13 a	1.16 ab	0.16 a	0.16 a	0.16 a	2.00 ab	1.98 a	1.99 a	0.56 b	0.52 a	0.54 a	0.16 a	0.14 a	0.15 a
Basrai	1.13 a	1.13 a	1.13 a	0.16 a	0.16 a	0.16 a	1.94 a	2.00 a	1.97 a	0.46 a	0.62 b	0.54 a	0.18 b	0.18 b	0.18 c
Williams	1.32 abc	1.26 ab	1.29 bc	0.15 a	0.17 a	0.16 a	2.08 abc	2.32 bc	2.20 b	0.63 c	0.73 c	0.68 c	0.20 c	0.18 b	0.19 d
Poyo	1.40 bcd	1.28 ab	1.34 cd	0.16 a	0.16 a	0.16 a	2.22 bcd	2.26 ab	2.24 bc	0.62 c	0.80 d	0.71 d	0.16 a	0.18 b	0.17 b
Maghrabi	1.45 cd	1.35 bc	1.40 cde	0.16 a	0.16 a	0.16 a	2.35 d	2.47 bc	2.41 cd	0.57 b	0.63 b	0.60 b	0.18 b	0.20 c	0.19 d
Paradica	1.70 ef	1.86 d	1.78 f	0.17 a	0.17 a	0.17 a	2.33 d	2.53 c	2.43 d	0.97 f	1.03 f	1.00 j	0.24 e	0.24 d	0.24 f
Ambel	1.38 bcd	1.50 c	1.44 de	0.18 a	0.18 a	0.18 a	2.19 bcd	2.29 b	2.24 bc	0.90 e	0.80 d	0.85 f	0.25 f	0.25 e	0.25 f
Mohamed Ali	1.55 de	1.41 bc	1.48 e	0.17 a	0.17 a	0.17 a	2.29 cd	2.33 bc	2.31 bcd	0.84 d	0.80 d	0.82 e	0.23 d	0.18 b	0.21 e
Sindihi	1.80 f	1.88 d	1.84 f	0.19 a	0.19 a	0.19 a	2.22 bcd	2.46 bc	2.34 bcd	1.03 j	0.97 e	1.00 j	0.27 j	0.25 e	0.26 j

Means followed by same letter (s), within each column, are not significantly different from each other at 5 % level.

significant differences were noticed. However , Sindihi fruits were somewhat high in their phosphorus content while Hindi , Basrai , Williams , Poyo , Maghrabi cultivars were nearly lower.

In addition , banana cultivars lied under two levels in pulp phosphorus content. The first level was from o.160 to 0.175 % for the majority of cultivars while the second range was from 0.176 to 0.190 for only Ambel and Sindihi cultivars.

As to the related reports , pulp phosphorus content was mentioned to vary between cultivars from 0.18 to 0.30 **(Von-Loesecke , 1950 and Walt and Merril , 1950).**

Regarding pulp potassium content , tabulated data indicated that banana cultivars differed in their values. Thus , the highest value was observed for Maghrabi and Paradica cultivars while Hindi and Basrai had fruits with the lowest values of potassium. However, other cultivars were in between.

Anyhow , significant differences were lacking between Hindi and Basrai , between Williams , Poyo , Ambel , Mohamed Ali and Sindihi cultivars, between Poyo , Maghrabi , Ambel , Mohamed Ali and Sindihi ; and between Maghrabi , Paradica , Mohamed Ali and Sindihi cultivars.

Furthermore , banana cultivars were classified under three groups as pulp potassium content was concerned. The first group had their fruits a range of potassium from 1.97 to 2.12 % . That was true for Hindi and Basrai cultivars. The second range was from 2.13 to 2.28 % for Williams , Poyo and Ambel cultivars. In last , the third class was from 2.29 to 2.43 % for Maghrabi , Paradica , Mohamed Ali, and Sindihi cultivars.

The available literature declared that potassium content in fruit pulp of different banana cultivars varied from 1.01 to 1.65 % **(Von-Loesecke , 1950 ; Garica et al , 1971 ; and Abd El-Kader , 1979).**

Meanwhile , data presented in **Table (20)** clearly disclosed that banana cultivars under study varied visually in their pulp calcium content. In this respect , both Paradica and Sindihi cultivars had fruits with the highest amounts of calcium . On the other hand , both Hindi and Basrai cultivars seemed to have fruits with the lowest values of pulp calcium content. By all means , other cultivars had intermediate values in this sphere.

Considering statistical analysis , differences between Hindi and Basrai as well as between Paradica and Sindihi cultivars were insignificant. Nevertheless , differences between other cultivars were so high to reach the significant level.

At all events , two ranges of pulp calcium content were observed for various banana cultivars under study. The first range was from 0.54 to 0.77 % for Hindi , Basrai , Williams , Maghrabi , and Poyo cultivars. On the other hand , the second group differed from 0.78 to 1.00 % for Ambel , Mohamed Ali, Sindihi , and Paradica banana cultivars.

Regarding earlier reports , pulp calcium content was mentioned to vary between different banana cultivars from 0.03 - 0.05 % **(Von-Loesecke , 1950).**

Referring to pulp magnesium content , data clarly showed that banana cultivars varied in their values. Thus , highest amount existed in fruit pulp of Sindihi cultivar (0.26 %) whereas Hindi

banana took a reverse trend in this respect (0.15 %). Anyhow , other cultivars had values in between. Moreover , differences between cultivars , from the statistical point of view , were almost significant except between Williams and Maghrabi , and between Paradica and Ambel cultivars.

Moreover , banana cultivars may be classified under two categories as pulp magnesium content was concerned. The first class covered Hindi , Basrai , Williams , Poyo , and Maghrabi cultivars which ranged from 0.15 to 0.20 % pulp magnesium content. The second group was from 0.21 to 0.26 % for Paradica , Ambel , Mohamed Ali , and Sindihi , cultivars.

As to the previous reports , pulp magnesium content was mentioned to vary between different cultivars from 0.15 - 0.20 % **(Von-Loesecke , 1950).**

4-IV.2.2. Leaf :

As shown in **Table (21)** , data declared that banana cultivars varied in their leaf nitrogen content. The highest amount (4.04 %) was noticed for Sindihi cultivar whereas leaves of Hindi contained the lowest amount (3.36%). Other cultivars lied in between.

However , differences between Hindi and Basrai ; between Williams , Poyo , Maghrabi and Ambel cultivars , and between Paradica , Mohamed Ali and Sindihi were insignificant.

On the other hand , banana cultivars under study showed three categories in leaf nitrogen content. The first level with a range from 3.36 to 3.59 for Hindi and Basrai cultivars. The second range

Table (21) : Leaf minerals content of different banana cultivars (1985/1986 and 1986/1987 seasons).

Cultivar	Element concentration in dry leaves (%)														
	N			P			K			Ca			Mg		
	85/86	86/87	Average	85/86	86/87	Average	85/86	86/87	Average	85/86	86/87	Average	85/86	86/87	Average
Hindi	3.29 a	3.43 a	3.36 a	0.20 a	0.22 a	0.21 a	4.05 a	4.13 ab	4.09 a	1.20 abcd	1.10 b	1.15 d	0.42 a	0.42 b	0.42 a
Basrai	3.36 a	3.52 ab	3.44 a	0.20 a	0.20 a	0.20 a	4.05 a	4.13 ab	4.09 a	1.15 abc	1.05 a	1.10 b	0.45 b	0.39 a	0.42 a
Williams	3.66 b	3.58 ab	3.62 bc	0.21 a	0.23 a	0.22 a	4.34 b	3.98 a	4.16 a	1.15 abc	1.15 c	1.15 d	0.55 d	0.45 c	0.50 b
Poyo	3.62 b	3.72 b	3.67 c	0.22 a	0.22 a	0.22 a	4.30 b	4.18 b	4.24 abc	1.11 ab	1.15 c	1.13 c	0.57 e	0.51 d	0.54 c
Maghrabi	3.66 b	3.58 ab	3.62 bc	0.21 a	0.23 a	0.22 a	4.11 a	4.13 ab	4.12 a	1.01 a	1.05 a	1.03 a	0.52 c	0.54 e	0.53 c
Paradica	3.91 cd	3.97 c	3.94 d	0.24 a	0.24 a	0.24 a	4.35 bc	4.43 cd	4.39 bcd	1.25 bcd	1.31 e	1.28 e	0.57 e	0.57 f	0.57 d
Ambei	3.76 bc	3.72 b	3.74 c	0.24 a	0.24 a	0.24 a	4.42 bc	4.38 c	4.40 cd	1.31 bcd	1.25 d	1.28 e	0.58 e	0.54 e	0.56 d
Mohamed Ali	4.00 d	4.00 c	4.00 d	0.23 a	0.23 a	0.23 a	4.31 b	4.13 ab	4.22 ab	1.35 cd	1.35 f	1.35 f	0.54 d	0.54 e	0.54 c
Sindihi	4.04 d	4.04 c	4.04 d	0.22 a	0.22 a	0.22 a	4.51 c	4.55 d	4.53 d	1.41 d	1.35 f	1.38 j	0.58 e	0.60 j	0.59 e

Means followed by same letter (s), within each column, are not significantly different from each other at 5 % level.

was from 3.60 to 3.83 for Williams , Poyo , Maghrabi and Ambel banana cultivars. The last level was from 3.84 to 4.04 which covered Paradica , Mohamed Ali , and Sindihi cultivars.

Regarding earlier banana reports , the leaf nitrogen percentage was mentioned to vary from 2.00 to 3.58 **(Hewitt , 1955 ; Boland , 1959 ; Murray , 1960 ; Vincenty et al , 1962 ; Caro - Costes et al , 1964 ; Twyford and Coulter , 1964 ; Randhawa et al , 1972 ; Messing , 1974 ; Ramaswamy and Muthukrishnan , 1974 ; Shawky et al , 1974 ; Warner et al , 1974 ; Warner and Fox , 1977 ; Lahave , 1977 ; Laghari and Khalidy , 1981 ; Holder and Gumbs , 1983-b , and Mayaz , 1987).**

Regarding leaf phosphorus content , outlined data indicated that leaf phosphorus of banana cultivars were similar from the statistical point of view since significant differences between various cultivars were lacking. However , Paradica and Ambel cultivars were higher than the other cultivars whilist Basrai tended to be the lowest in this respect.

The critical leaf phosphorus level in healthy banana cultivars was reported to vary between 0.13 and 0.45 % **(Hewitt , 1955 ; Boland , 1959 ; Murray , 1960 ; Vincenty et al , 1962 ; Caro - Costes et al , 1964 ; Twyford and Coulter , 1964 ; Randhawa et al , 1972 ; Warner et al , 1974 ; Ramaswamy , 1976 ; Warner and Fox , 1977 ; Laghari and Khalidy , 1981 ; and Holder and Gumbs , 1983-b).**

As for leaf potassium content , it is quite evident that banana cultivars varied slightly from 4.08 % for Basrai to 4.53 % for Sindihi. Thus , significant differences between cultivars were very narrow.

By all means , significant differences between Hindi , Basrai , Williams , Poyo , Maghrabi , and Mohamed Ali ; between Paradica , Ambel and Sindihi as well as between Poyo , Paradica , and Mohamed Ali were almost lacking. In addition , banana cultivars could be divided into two groups in this concern. The first group was from 4.08 to 4.30 % for the most cultivars except Sindihi , Ambel , and Paradica cultivars which covered the second range from 4.31 to 4.53 %.

As to the related reports , leaf potassium content was mentioned to vary from 3.2 to 4.7 % in different banana cultivars **(Hewitt , 1955 ; Baland , 1959 ; Murray , 1960 ; Caro - Costes et al , 1964 ; Twyford and Coulter , 1964 ; Randhawa et al , 1972 ; Messing , 1974 ; Warner et al 1974 ; Jambuling et al , 1975 ; Warner and Fox , 1977 ; Lahave , 1977 ; Laghari and Khalidy , 1981 ; and Holder and Gumbs , 1983-b).**

Regarding leaf calcium content , it is noticeable that banana cultivars varied in thier values with the highest value (1.38 %) for Sindihi whereas Maghrabi was the most inferior cultivars (1.03 %). Other cultivars were in between in this respect. On the other hand , statistical analysis showed that significant differences between Hindi and Williams as well as between Paradica and Ambel cultivars were almost abscent. On the contrary, other cultivars under study showed significant differences in this respect .

Meanwhile , the obtained data also pointed out that banana cultivars showed in their values three categories of leaf calcium content. The first level was from 1.03 to 1.14 % for Maghrabi , Basrai , and Poyo while the second one differed from 1.15 to 1.26 for Hindi and Williams. On the other side , the third level was extended

from 1.27 to 1.38 % for Paradica , Ambel , Mohamed Ali and Sindihi cultivars.

As to the available banana reports , the foliar critical value of calcium was shown to vary from 0.6 to 1.4 % in different banana cultivars (**Boland , 1959 ; Murray , 1960 ; Vincenty et al . 1962 ; Messing , 1974 ; Warner and Fox , 1977 ; Laghari and Khalidy , 1981 ; and Holder and Gumbs , 1983 - b).**

As for leaf magnesium content was concerned , data clearly indicated that leaf magnesium content varied from 0.42 % for both Hindi and Basrai cultivars to 0.59 % for Sindihi. Other cultivars under study fell in between in their values. Nevertheless , differences between various cultivars were narrow. Thus , differences between Hindi and Basrai, between Poyo , Maghrabi , and Mohamed Ali , as well as between Paradica and Ambel were so small to be statistically significant.

The critical leaf magnesium level for healthy banana cultivars was reported to vary from 0.24 to 0.60 % **(Boland , 1959 ; Murray , 1960 ; Vincenty et al . 1962 ; Messing , 1974 ; Warner and Fox , 1977 ; Laghari and Khalidy , 1981 ; and Holder and Gumbs , 1983 - b).**

4-IV.3. Corm analysis :

4-IV.3.1. Corm total carbohydrates :

Data presented in **Table (22)** showed that banana cultivars varied significantly in their corm total carbohydrates content.

Table (22) : Corm total carbohydrates , nitrogen and C/N ratio of different banana cultivars (1985/1986 and 1986/1987 seasons).

Cultivar	Total carbohydrates (%)			Nitrogen (%)			C / N		
	85/86	86/87	Average	85/86	86/87	Average	85/86	86/87	Average
Hindi	22.54 a	22.50 a	22.52 a	2.16 a	2.17 a	2.17 a	10.44 cd	10.37 cde	10.41 e
Basrai	22.84 b	22.69 b	22.77 b	2.21 c	2.22 c	2.22 c	10.37 cd	10.25 c	10.31 c
Williams	23.37 c	23.38 d	23.38 e	2.19 b	2.18 b	2.19 b	10.67 e	10.76 f	10.72 f
Poyo	23.26 c	23.32 d	23.29 d	2.24 e	2.26 f	2.25 f	10.39 cd	10.31 cd	10.35 cd
Maghrabi	23.37 c	23.35 d	23.36 e	2.23 d	2.25 e	2.24 e	10.48 d	10.38 cde	10.43 e
Paradica	24.18 d	24.23 e	24.21 j	2.49 j	2.53 h	2.51 h	9.73 b	9.60 b	9.67 b
Ambel	24.13 d	24.16 e	24.15 f	2.34 f	2.32 j	2.33 j	10.33 c	10.44 e	10.39 de
Mohamed Ali	23.17 c	23.22 c	23.20 c	2.23 d	2.24 d	2.24 d	10.40 cd	10.39 de	10.40 de
Sindihi	24.16 d	24.23 e	24.20 j	2.83 h	2.90 i	2.87 i	8.56 a	8.37 a	8.47 a

Means followed by same letter (s), within each column, are not significantly different from each other at 5 % level.

Nevertheless , no significant difference was noticed between Williams and Maghrabi as well as between Paradica and sindihi cultivars in their corm total carbohydrates content. In this respect , the highest cultivars in corm total carbohydrates were Paradica and Sindihi cultivars whereas the lowest ones was Hindi. Other studied cultivars were in between in their values.

Moreover , banana cultivars could be divided into three groups according to corm total carbohydrates content. The first group ranged from 22.52% to 23.08% for Hindi and Basria cultivars. The second range was from 23.09 t0 23.65%. That was true for Williams , Poyo , Maghrabi , and Mohamed Ali cultivars. In addition , Paradica , Ambel , and Sindihi banana cultivars fell in the third group which varied from 23.66 to 24.21 % in their corm total carbohydrates.

As to the related reports , percentage of total carbohydrates in Hindi banana corms was mentioned to vary from 21.88 to 24.84 **(Sweidan , 1972 ; and El-Khoreiby , 1980)**.

4-IV.3.2. Corm nitrogen content :

Table (22) revealed that banana cultivars varied significantly in their corm nitrogen content. However , Sindihi surpassed all other cultivars in their corm nitrogen content (2.87 %) whilist Hindi cultivar took the other way around in this respect , where its corm contained 2.17 % N. Anyhow , other cultivars were in between in their values.

Furthermore , data indicate that banana cultivars , except Paradica and Sindihi , lied under the range from 2.17 to 2.40 % in their corm nitrogen content.

As to the available banana reports , percentage of nitrogen in Hindi banana corms vary from 1.11 to 2.52 **(Sweidan , 1972 , and El-Khoreiby , 1980)**.

4-IV.3.3. Corm C/N ratio :

It is clear that values of corm C/N ratio varied from 8.47 for Sindihi to 10.72 for Williams cultivar. In spite of that , no significant differences were noticed between Poyo , Ambel , and Mohamed Ali , between Hindi , Maghrabi , Ambel , and Mohamed Ali , and between Basrai and Poyo cultivars in corm C/N ratio. Moreover , obtained results revealed also that all studied banana cultivars , except Sindihi and Paradica , fell under the range from 9.99 to 10.72. Anyhow , Sindihi and Paradica cultivars had values of 8.47 and 9.67 , respectively.

Regarding the related reports , C/N ratio in Hindi banana corms was mentioned to vary from 10.38 to 20.95 **(Sweidan , 1972 ; and El-Khoreiby , 1980)**.

4-V. Cold hardiness :

4-V.1. Injury index :

Table (23) show the injury of different banana cultivars during both seasons of study. It is clear that banana cultivars varied in their cold hardiness (Injury index). Thus , the highest values of injury index appeared for Hindi and Basrai whereas the lowest one was Mohamed Ali. Other cultivars , however , were intermediate in their values. Moreover , statistical analysis indicated that no significant differences were noticed between Hindi , Basrai and Poyo cultivars. Anyhow , other cultivars varied statistically in their values.

Furthermore , banana cultivars could be arranged in three groups concerning injury index. In this sphere , Mohamed Ali , Sindihi , and Paradica cultivars represent the first group showing injury index lower than 82. The second class differed from 82 to 90.5 for Ambel and Maghrabi cultivars. The last group was > 95.6 which covered Hindi , Basrai , Williams , and Poyo cultivars.

The related banana literature with banana leaf tissue declared the value of Injury index of about 55 was obtained after subjecting leaf tissue for one hour at -6°c (**Shaw ky et al , 1983**).

Table (23): Injury index of different banana cultivars (1985/1986 and 1986/1987 seasons).

Cultivar	Injury index * (It).		
	1985/1986	1986/1987	Average
Hindi	99.25 h	98.67 f	98.96 j
Basrai	98.90 jh	98.14 f	98.52 j
Williams	96.03 f	96.14 e	96.09 f
Poyo	98.11 j	98.73 f	98.42 j
Maghrabi	89.89 e	89.77 d	89.83 e
Paradica	77.43 b	76.92 b	77.18 b
Ambel	88.68 d	88.80 d	88.74 d
Mohamed Ali	74.00 a	73.92 a	73.96 a
Sindihi	80.87 c	80.54 c	80.71 c

* Index of injury resulting from expsure to temp -6 c [It = 100 (Lt - Lo) /(Lk - Lo)].

Means followed by same letter (s), within each column, are not significantly different from each other at 5 % level.

4-VI. Evaluation of banana cultivars:

Data presented in **Tables (24 and 25)** show that the characteristics concerned in evaluating the studied banana cultivars were : Shorter period from bunch shooting to harvesting , low height / circumference ratio of pseudostem , low injury index , heavy bunch weight , heavy finger weight , longer finger , high pulp percentage , high total sugars / starch ratio of ripe pulp , and high finger hardiness.

Referring to period from bunch shooting to harvesting , it is clear that the shortest period was 2.5 months , whereas , the longest one was 4.4 months and the representative period of the population was 3.45 months. Consequently , fruits of Paradica , Ambel , Mohamed Ali and Sindihi appeared to be earlier in the markat.

Considering height / circumference ratio of pseudostem (wind hardiness) , the highest ratio was 5.94 whereas the lowest one scored 2.38 , with a general mean of 4.18. Therefore , Basrai , Hindi , Williams , Maghrabi and Poyo are considered more wind hardiness cultivars.

Regarding injury index (cold hardiness) , it is clear that the limits of population were 73.96 - 98.96 with a general mean of 86.46. Consequently , Mohamed Ali , Paradica and Sindihi cultivars are the lowest effective cultivars by cold injuries.

Regarding bunch weight , it is quite evident that the heaviest bunch recorded 26.6 kg. and the lightest one was 8.5 kg. However ,

Table (24) : Evaluation of different banana cultivars based on nine characters .

Cultivar	Plant adaptability			Yield	Fruit quality				
	Period from bunch shooting to harvesting (mounths)	Height/girth ratio of pseudostem (wind hardiness)	Injury index (cold hardiness)	Bunch weight (kg.)	Finger weight (g.)	Finger length (cm.)	Pulp pecentage	Sugars/ starch ratio of ripe pulp	Finger hardiness (kg.)
Hindi	--	2.42	--	--	--	--	--	6.75	--
Basrai	--	2.38	--	19.60	--	--	--	7.00	--
Williams	--	3.29	--	24.60	117.70	20.19	--	7.44	54.00
Poyo	--	3.95	--	22.40	95.40	18.30	--	7.68	51.00
Maghrabi	--	3.73	--	22.70	92.70	17.30	--	7.88	48.40
Paradica	2.50	--	77.17	18.40	--	--	76.10	--	--
Ambel	2.50	--	--	--	--	--	81.90	--	--
Mohamed Ali	2.50	--	73.96	--	--	--	76.10	--	--
Sindihi	2.50	--	80.71	20.40	127.30	--	--	--	--

Table (25) : First step of evaluation of different banana cultivars .

Cultivar	Plant adaptability			Yield	Fruit quality				
	Period from bunch shooting to harvesting (mounths)	Height/girth ratio of pseudostem (wind hardiness)	Injury index (cold hardiness)	Bunch weight (kg.)	Finger weight (g.)	Finger length (cm.)	Pulp pecentage	Sugars/ starch ratio of rip pulp	Finger hardiness (kg.)
Basrai	4.40	2.38	98.59	19.60	77.50	15.80	62.40	7.00	45.60
Williams	3.50	3.29	96.08	26.60	117.70	20.19	72.10	7.44	54.00
Poyo	3.50	3.95	98.42	22.40	95.40	18.30	65.50	7.68	51.30
Maghrabi	3.50	3.75	89.83	22.70	92.70	17.74	68.10	7.88	48.40
Paradica	2.50	4.53	77.17	18.40	88.50	13.25	76.10	2.09	41.40
Sindihi	2.50	4.32	80.71	20.40	127.30	15.09	63.20	1.19	41.30

the representative bunch weight of the population was 17.55 kg. Consequently , cultivars i. e. Williams , Maghrabi , Poyo , Paradica , Sindihi and Basrai had the heaviest bunches.

As for finger weight , limits of the population were 49.2 - 127.3 g. with average of 88.25 g. Consequently , cultivars i.e. Sindihi , Williams , Poyo , and Maghrabi produced heaviest fingers.

Regarding finger length , disclosed data indicated that , the longest finger recorded 20.19 cm. while the shortest one was 9.89 cm. Meanwhile , the representative finger of the population was 15.80 cm. length. Consequently , Williams , Poyo and Maghrabi cultivars produced longer fingers.

With respect to pulp percentage , it is obvious that the highest percentage was 81.9 % whereas the lowest one was 62.4 % with general mean of the population of 72.15. Therefore , fingers of higher pulp percentage were showed with those of Ambel , Mohamed Ali , Paradica , Williams , Maghrabi , Poyo and Sindihi cultivars.

Regarding total sugars / starch ratio of ripe pulp , it is clear that the highest sugars / starch ratio was 7.88. Meanwhile , the lowest one was 1.19 with general mean of population of 4.54. Accordingly , pulp of higher ratio was noticed with those of Maghrabi, Poyo Williams , Basrai and Hindi.

As for finger hardiness , tabulated data indicated that values of finger hardiness ranged between 38.1 - 54.0 with general average of 46.05. Therefore , hard fingers were noticed with Williams , Maghrabi and Poyo cultivars.

Consequently , the evaluated cultivars having at least four recommended characters of fruit quality and yield were Basrai , Williams , Poyo , Maghrabi , Paradica and Sindihi. These cultivars were subjected to further evaluation through grading system **(Table 26)**.

Concisely , as a result of evaluation by grading method one can conclude that banana cultivars recommended for environmental conditions similar to El-Kanater area are Williams (80.59 %) followed by Maghrabi (52.71 %). However , Poyo cultivar ranked the third in this evaluation (48.88 %).

Table (26) : Second step of evaluation of different banana cultivars according to their adaptabilty , yield and fruit quality through grading system.

Properties	Evaluation			Cultivars					
	Points	Value	Selected cultivar	Basrai	Williams	Poyo	Maghrabi	Paradica	Sindihi
Plant adaptability									
period from bunch shooting to harvesting	10	2.50	Paradica and Sindihi	0.00	4.74	4.74	4.74	10.00	10.00
Height/girth ratio of pseudostem	10	2.38	Basrai	10.00	5.77	2.70	3.72	0.00	0.98
Injury index	5	77.17	Paradica	0.00	0.59	0.04	2.04	5.00	4.17
Yield									
Bunch weight ..... (kg.)	30	26.60	Williams	4.39	30.00	14.63	15.73	0.00	7.32
Fruit quality									
Finger weight ..... (g.)	10	127.30	Sindihi	0.00	8.07	3.59	3.05	2.21	10.00
Finger length ..... (cm)	10	20.19	Williams	3.67	10.00	7.28	6.47	0.00	2.65
Pulp percentage	10	76.10	Paradica	0.00	7.08	2.26	4.16	10.00	0.58
Sugars/starch ratio of ripe pulp	10	7.88	Maghrabi	8.69	9.34	9.70	10.00	1.35	0.00
Finger hardiness	5	54.00	Williams	1.65	5.00	3.94	2.80	0.04	0.00
Total	100	--		28.40	80.59	48.88	52.71	28.60	35.70