J. Agric. Sci. Mansoura Univ., 28 (2): 759 - 774, 2003

DYNAMICS OF YIELD OF FOURTEEN WHITE AND YELLOW MAIZE (*Zea mays* L.) HYBRIDS GROWN IN EGYPT

Sadek, E.S.; M.S.M. Soliman and A.A . Barakat
Maize Res. Prog., Field Crops Research Institute, A R C, Egypt.

ABSTRACT

Two field experiments were carried out at Gemmeiza Agricultural Research Station in 1999 and 2000 seasons to study dynamics of yield of fourteen white and yellow maize hybrids. These hybrids were nine white single and three way crosses *i.e.* SC10, SC21, SC22, SC23 and SC24, TWC321, TWC 322,TWC 323 and TWC 324; and five yellow single and three-way crosses *i.e.* SC 51, SC52 and SC155; TWC 351 and TWC 352.

Results obtained can be summarized as follows: -

1- Variety differences were obtained in growth parameters, *i.e.* grain yield and its components, and photosynthates partitioning, where maize hybrids differed in glucose required for synthesis, carbon equivalent, yield energy per plant and/or per fed. for grain and straw yield, biological yield per fed (above ground biomass/fed), coefficient of crop index and harvest index.

2- Maize grain yield could be increased by growing white single crosses 10 and 22, yellow single cross 155; white three way crosses 321 and 322 and the yellow three way cross 352, where, these hybrids characterized by their highest value from vegetative growth; grain yield and its components and photosynthetic partitioning towards the economic yield in comparison with other eight white and yellow hybrids under study.

INTRODUCTION

The expansion in cultivating high yielding, single and three way cross maize hybrids, particularly those bred and developed in Egypt resulted in increasing grain yield especially due to following the technical recommendations of maize production .The agricultural policy of Egypt gives a great attention to increase maize production using both vertical and horizontal ways. The yield potential of maize plant can be defined as the total biomass produced or the economic part of the crop. The total biomass is a result of the integration of metabolic activity of the plant at any period of its growth, which can affect grain yield. Metabolic processes in maize plant are greatly governed by both internal i.e. genetic make up of the plant and external conditions, which involve two main factors namely climatic and edaphic environmental factors. The yield potential of maize could be regulated through alternation of genetic structure through breeding programs and/or by modifications of environment through improving cultural treatments.

However, Egyptian maize hybrids may differ in their assimilating capacity and distribution of photosynthates between the various plant organs which could be referred to as " Source and sink relation ". Yield dynamics means having a certain yield by changing the yield components, *i.e.* number of rows per ear, number of kernels per row and average grain yield weight per ear. In this respect, Prior and Russel (1976) indicated that maximum production could be obtained by providing an adequate sink for photosynthate transfer. They added that in many cases P and K applications by vegetative organs whereas, S.C.10 required more glucose for synthesis of protein by vegetative organs, also, with respect to glucose required for synthesis of chemical components by kernels, S.C.21 required more glucose for synthesis of carbohydrate. Meanwhile, S.C.155 required more glucose for synthesis of protein and oil. Regarding straw, S.C.21 required more glucose for synthesis of carbohydrate, however, S.C. 51 required more glucose for synthesis of protein in straw.

In respect of carbon equivalent, according to Hanson *et al.*(1960), carbon equivalent is defined as the gram atoms of sugar carbon required to produce an end product including both gram atoms of work carbon lost in the synthesis and gram atoms of carbon stored in the product. Data reported in Table (3) showed that significant differences were detected among maize hybrids in carbon equivalent for each carbohydrate of vegetative organs, kernels and straw, as well as, protein in vegetative organs and straw, and. oil in kernels. However, the hybrid differences in carbon equivalent for protein in kernels did not reach to the significant level at 5%. Moreover, TWC352 characterized with a high carbon equivalent for carbohydrate. Meanwhile, S.C.10 showed a high carbon equivalent for protein in vegetative organ. On the other hand, S.C.21 characterized with a high carbon equivalent for carbohydrate, whereas, S.C.155 characterized with a high carbon equivalent for protein and oil of kernels. In addition S.C.21 and S.C.51 characterized with a high carbon required for carbohydrate and protein in straw, respectively.

Data presented in Table (4) showed that there were significant differences among maize hybrids in yield energy per plant and per fed, where, maize hybrids significantly differed in energy yield for each of carbohydrate, protein and oil. S.C.10 surpassed the other thirteen maize hybrids under study in energy yield of carbohydrate and protein and total yield energy in kernels yield per plant and or per fed. Meanwhile, T.W.C321 gave the greatest energy yield for oil per kernels. Considering straw energy yield/plant at harvest S.C.21 outweighed other studied thirteen maize cultivars in energy yield for carbohydrate and total energy per straw. However, TWC352 characterized by the highest energy yield for protein in straw. Furthermore, data in Table (4) revealed that S.C.10 gave the greatest mean value of total energy for kernels yield per fed and energy yield for carbohydrate and protein. In addition, S.C. 51 exceeded other maize hybrids in total energy yield of straw per fed and its attributes (i.e. energy yield for carbohydrate and protein of straw). Regarding energy coefficient of crop index and harvest index, it is observed that S.C.10 was the highest hybrid in these two characters (Table 4). It is worthy to mention that the white single cross S.C.10 exceeded the other white single crosses; S.C.21, S.C.22, S.C.23 and S.C.24 in each of energy yield for carbohydrate and protein from kernels yield and total energy of kernels per plant and or / per fed.

In this respect, the present results are in a harmony with those obtained by Ahmed and Sadek (1992), El- Sherbieny *et al.* (1994), Gado *et al* (1994) and Sadek *et al.* (1994 a and b), who indicated that hybrids differed in partitioning and migration of the total available photosynthate to

Table 4: Varietal differences in energy/ grain, yield energy per plant and per fed. at harvest of the evaluated fourteen maize hybrids. (Average of 1999 and 2000 seasons)

Hybrid Characters	S.C 10	S.C 21	S.C 22	S.C 23	S.C 24	S.C 151	S.C 152	S.C 155	T.W.C 321	T.W.C 322	T.W.C 323	T.W.C 324	T.W.C 351	T.W.C 352	L.S.D 5%
Yield energy/P. at harvest K cals															
Kernels															
Carbohydrate	713.18	651.03	666 78	657.85	629.87	570.90	590.74	606.30	602.19	593.89	573.04	565.82	551.85	585.64	24.7
Protein	143.42	125.73	134.07	130.97	129.59	122.64	126.64	131.81	125.22	121 65	117.64	114.11	108 79	116 89	11.4
Oil	117.76	107 48	110.35	107.31	122.74	108.31	115.27	120.03	123.43	120.50	113.88	113.12	102.99	116.07	14.0
Total	974.36	884.24	911.02	896.13	882.20	801.85	832.65	858.14	850.84	83604	804.56	793.05	763.63	818.60	34.9
Straw															
Carbohydrate	755.67	814.98	782.22	790.17	747.33	704.27	718.80	701.90	680.78	736.63	752.59	775.71	780.80	791.17	15.3
Protein	141.26	148.87	146.57	147.39	144.98	137.93	138.20	137.69	139.10	150.98	148.54	157.47	156.03	159.36	18.8
Total	896.93	963.85	928.79	937.56	892.31	842.2	857.00	839.59	819.88	887.61	901.13	933.18	936.83	950.53	16.2
Yield energy/Feddan at harvest 1000 K cals															
Kernels															
Carbohydrate	1122.7	10596.9	10652.8	10081.9	10002.5	9029.86	9394.44	9952.15	10416.6	10344.4	9847.08	9559.13	8706.43	9110.01	306.4
Protein	2398.7	2046.52	2142.02	2007.14	2057.91	1939.71	2013.95	2163.56	2165.99	248.97	2021.57	1927.75	1716.31	1818.31	125.3
Oil	1969.4	1749.53	1763.06	1644.62	1949.14	1713.06	1833.13	1970.16	2135.02	2098.81	1956.99	1911.10	1624.85	1805.55	258.9
Total	16295.9	14392.95	14557.9	13733.74	14009.64	12682.63	13241.52	14085.87	14717.63	14562.2	13825.64	13397.98	12047 59	12733.87	133.7
Straw															
Carbohydrate	7437.9	7241 12	7260.89	7703.45	7358.85	7931.21	8338.58	8760.31	6705 78	6851.20	6687.48	7262.63	7951.35	8369.89	178.8
Protein	1390.4	1322.67	1360.49	1436.95	1427.62	1553.29	1603.21	1718.43	1370.18	1404.18	1319.89	1474.32	1588.99	1684.68	145.9
Total	8828.3	8563.79	8621.38	9140.4	8786.47	9484.50	9941.79	10478.74	8075.96	825538	8007.37	8736.59	9540.34	10048.57	147.5
Energy cofficient															
Energy coefficient of crop index	0 65	0.63	0.63	0.60	0.61	0.57	0.57	0.57	0.65	0.64	0.63	0.61	0.56	0.56	0.03
Energy coefficient of crop index	1 85	1.68	1.69	1.50	1.59	1.34	1.33	1 34	1.82	1.76	1 73	1.53	1.26	1.27	0.17

economic yield, in carbon equivalent for vegetative matter, kernels and straw, yield energy of kernels and straw per plant and per fed and energy coefficient of crop index and harvest index.
It can be concluded that the harvested maize yield can be increased by growing white single crosses, i.e. S.C.10 and S.C.22, the yellow single cross S.C.155, the white three way crosses 321 and 322, as well as, the yellow three way cross 352.

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ديناميكية المحصول في أربعة عشر هجيناً من الذرة الشامية البيضاء والصفـــراء المنزرعة في مصر

صادق الشحات صادق - محمد سليمان محمد سليمان - عفيفي عبد المعبود بركات
معهد بحوث المحاصيل الحقلية - مركز البحوث الزراعية بجمهورية مصر العربية

تم إقامة تجربتين حقليتين بمحطة البحوث الزراعية بالجميزة موسمى ١٩٩٩، ٢٠٠٠ وذلك بغـــرض دراسة ديناميكية المحصول في أربعة عشر هجيناً من هجن الذرة الشامية منها تسعة هجن بيضاء الحبـــوب هي هــ.ف ١٠ ، هــ.ف ٢١ ، هــ.ف ٢٢ ، هــ.ف ٢٣ ، هــ.ف ٢٤, والهجن الثلاثية ٣٢١ ، ٣٢٢, ٣٢٣ ، ٣٢٤ ،وخمسة هجــن صفراء الحبوب هى هــ.ف ٥١ , هــ.ف ٥٢ , هــ.ف ١٥٥والـــهجينان الثلاثيان ٣٥١ ، ٣٥٢ ، وذلك بغرض دراسة متغيرات المحصول وتوظيف وهجرة المادة الجافة المتكونـــة في هجن الذرة الشامية تحت الدراسة لإمداد المربي بأفضل الصفات اللازمة في برنامج التربية والانتخـــاب للوصول للنبات المثالي مما يؤدي لتحديد أفضل التراكيب إنتاجية تحت الظروف المصرية.

وتتلخص النتائج المتحصل عليها فيما يأتى :-

١. كان هناك تباين بين الأصناف فى قياسات النمو ومحصول الحبوب ومكوناته بالإضافة الـــي مكونـــات التمثيل الضوئي حيث اختلفت الهجن في كميات الجلكوز والكربون المطلوبة وكذلك كمية الطاقة للنبـــات أو الفدان.كما وجدت تباينات في محصول القش و الحبوب ,والمحصول البيولوجي للفدان ومعامل دليـــل المحصول ودليل الحصاد.

٢. يمكن زيادة محصول الحبوب بزراعة الهجن الفردية البيضاء ١٠, ٢٢ والهجين الفردي الأصفـــر ١٥٥ وكذلك الهجن الثلاثية البيضاء ٣٢١, ٣٢٢ والهجين الثلاثي الأصفر ٣٥٢ حيث تتميز هذه الهجن بـــالقيم العالية لمعدلات النمو الخضري ومحصول الحبوب ومكوناتة وكذلك مكونات التمثيل الضوئي المؤديـــة الي أفضل محصول اقتصادى وذلك مقارنة بالثمانية هجن البيضاء و الصفـــراء الأخـــرى فـــي هـــذه الدراسة.