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Evaluation Trial of Some Ecotypes of Balady Cabbage (*Brassica oleraceae* var. *Capitata* L.) Under Sohag Conditions

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Abstract: Ten Egyptian ecotypes, of cabbage (*Brassica oleraceae* var. *capitata* L.) were assessed for yield, earliness and some quality characteristics at the Experimental Farm, Faculty of Agriculture, Sohag University during two successive seasons, 2009/2010 and 2010/2011. There were differences among genotypes for yield and earliness studied characters. "El-Fayum" and "El- Minofia" accessions were the earliest to 50% head formation and took the lowest number of days to maturity and ending their life cycle. While "El- Sharkia" accession was the latest to 50% head formation and had the highest number of days to maturity and ending their life cycle. "El-Sharkia" and "El-Giza" accessions produced the highest Gross Yield and Marketable head weight. "El-Dakhalia" accession gave the lowest Gross Yield. while, 'El-Fayum' accession produced the lowest Marketable head weight. The results of this study could be useful in breeding programs for improving cabbage production in Upper Egypt.

Key words: Cabbage accession · Gross Yield · Genotypes · Net head weight · Non-edible plants · Harvest Index · Productivity Score

INTRODUCTION

In Egypt, about 44720 feddan[1] of cabbage crop are cultivated annually and produced about 541915 tons. Cabbage (*Brassica oleraceae var capitata*) has been grown widely in Egypt and it is considered one of the major vegetable crops. Cabbage is grown for several purposes. Fresh market cabbage is for cooking or salad use.

The local 'Balady' cultivar of cabbage is characterized by a big compact head with round inner leaves, yellowish white in color, thin, slightly veined and smooth. All these prosperities satisfies the Egyptian consumer to use the cabbage in a stuffed form. 'Balady' cultivar is widely grown all over the country the year round except months of very low temperatures such as winter and early spring, because the Balady cultivar is easily stimulated to early or premature flowering when exposed to relatively low temperature.

Several Egyptian farmers in most areas of large cabbage production used to produce their own needs of Balady cultivar every year. By repeated cultivation for several years under certain environmental conditions, some landraces (ecotypes) of the Balady cultivar has been arised.

Many investigators studied growth, quality and yield variations of cabbage crop [1-23]. Researchers and farmers have noted the deterioration in yield and head characteristics of local cabbage cultivars. The objective of this study was to evaluate the performance of 10 local cabbage genotypes for yield, earliness and some quality characteristics.

MATERIALS AND METHODS

Plant Materials: Ten ecotypes were used in the present study. They were collected from various provinces in Egypt where they have been commonly grown for several

[1]Feddan is 4200 m2, approximately 0.42 ha. The data were from the Ministry of Agriculture and Land Reclamation Statistics, 2005.

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decades. Landraces of Cabbage was a kind gift of Dr. Mohamed Hamam Z. El-Abedien (Associate Professor, of vegetable crops, Department of Horticulture, Faculty of Agriculture, Assuit University, Assuit, Egypt)

Field Trial Layout: Two years field trial (2009/2010 and 2010/ 2011) was executed at the Experimental Farm of Faculty of Agriculture, Sohag University, Sohag, Egypt to evaluate the 10 cabbage entries for earliness, yield and quality characteristics. The two years trial was conducted using seeds from the same seed lots. The experimental design was a randomized complete block with 3 replications. Each experimental unit (plot) consisted of four ridges giving about 10.5 m^2 area, containing 28 plants/plot. Seeds were planted in the nursery, at about 5.0 cm distance, on the northern side of ridges 25-30 cm apart on June 1st in both seasons. Transplants were placed at 50 cm apart on the northern side of ridges 3.5 m long and 75 cm wide on July 1st in both seasons. Fertilization, irrigation and other cultural practices were carried out as recommended for cabbage commercial production [24].

Each plot was observed to record time of head formation on 50% plants. As heads reached marketable stage, 5 plant were randomly taken from the outer two ridges of each plot to record the following characters: 1) Fresh weight of the entire plant fresh weight (kg), 2) Weight of non-edible plants [wrapper leaves + stem (kg)], 3) Plant stem weight (kg), 4) Plant stem length (cm), 5) Marketable head weight [edible leaves + wrapper leaves) (kg)], 6) Net head weight [edible leaves (kg)], 7) Gross yield (ton/fed), 8) Day from transplanting dates to 50% harvest, 9) Days from transplanting to the end of harvest, 10) Duration of harvest period (days), 11) Harvest Index, 12) Productivity Score

All recorded data were statistically analyzed [25] and treatment means were compared using the Duncan's multiple range test (DMRT) at 0.05 probability level.

RESULTS AND DISCUSSION

As shown in Tables 1 significant differences were recorded among cabbage entries only in the second season for Plant stem weight. "Assuit" landrace had the greatest plant stem weight while Plants of accession "El-Minofia" gave the lowest value in stem weight.

No significant differences were found among cabbage entries in both seasons for Fresh weight of the entire plant, Weight of non-edible plants and Net head weight. "Assuit" landrace gave the highest mean values for all these characters. Landraces "Bani-Sweaf" produced the lowest mean value for Weight of non-edible plants and Net head weight traits. "El-Fayum" landrace had the lowest mean value for Fresh weight of the entire plant character.

Tables 2 present yield (Gross Yield (ton/fed) and Marketable head weight (kg)) and earliness in maturity (Day from transplanting dates to 50% harvest and Days from transplanting to the end of harvest) of the 10 cabbage studied entries during two successive seasons. Significant differences were found for yield and earliness maturity measurements in both seasons. 'El-Sharkia' and "El-Giza" ecotypes produced the highest Gross Yield

Table 1: Fresh weight of the entire plant (kg), Weight of non-edible plants (kg, wrapper leaves + stem), Plant stem weight (kg) and Net head weight (kg) of the ten studied accessions of cabbage during 2010- 2011 season.

Code No	Genotypes of Cabbage	Fresh weight of the entire plant (kg)		Weight of non-edible plants (kg, wrapper leaves + stem)		Plant stem weight (kg)		Net head weight (kg)	
		2010	2011	2010	2011	2010	2011	2010	2011
1	Sohag	10.03 A	8.900 A	3.900 A	3.167 A	0.3967 A	0.3967CD	6.167 A	5.767 A
2	Bani-Sweaf	9.067 A	8.000 A	3.833 A	2.967 A	0.3233 A	0.3767CD	5.167 A	5.033 A
3	El-Sharkia	10.63 A	8.933 A	4.267 A	3.067 A	0.5967 A	0.4867ABC	6.400 A	5.933 A
4	Assuit	10.83 A	9.233 A	4.200 A	3.433 A	0.5933 A	0.5500 A	6.567 A	5.767 A
5	El-Minofia	10.17 A	8.533 A	3.900 A	3.200 A	0.3333 A	0.3400 D	6.267 A	5.333 A
6	El-Fayum	9.067 A	7.967 A	3.933 A	2.933 A	0.3200 A	0.3933 CD	5.133 A	5.333 A
7	El-Giza	10.43 A	9.333 A	4.067 A	3.400 A	0.4500 A	0.4533ABCD	6.367 A	5.967 A
8	El-Minia	10.07 A	9.133 A	3.800 A	3.400 A	0.4433 A	0.5400 AB	6.367 A	5.767 A
9	El-Dakhalia	9.933 A	8.433 A	3.733 A	3.400 A	0.6267 A	0.4900 ABC	6.267 A	5.067 A
10	El-Kaluobia	9.733 A	8.767 A	3.800 A	3.233 A	0.4300 A	0.4233 BCD	5.933 A	5.500 A
CV (%)	9.78	9.64	12.21	14.94	24.12	14.07	11.39	14.10	

Mean followed by the same letter(s) are not significantly different at the 5% level of probability

Table 2: Gross Yield (ton/fed), Marketable head weight (kg, edible leaves + wrapper leaves), Day from transplanting dates to 50% harvest and Days from transplanting to the end of harvest of the ten studied accessions of cabbage during 2010- 2011 season.

Code No.	Genotypes of Cabbage	Gross Yield (ton/fed)		Marketable head weight (kg)		Day from transplanting dates to 50% harvest		Days from transplanting to the end of harvest	
		2010	2011	2010	2011	2010	2011	2010	2011
1	Sohag	44.33 ABC	52.10 A	8.767ABC	7.800 A	156.2 D	167.8 B	186.8 CDE	199.5BCD
2	Bani-Sweaf	43.80 ABC	47.53 AB	8.033 BC	7.167 A	158.0 CD	168.2 B	189.3BCDE	198.8BCD
3	El-Sharkia	50.13 A	50.57 A	9.500 A	7.833 A	176.1 A	189.6 A	211.2 A	217.9 A
4	Assuit	48.03 A	47.47 AB	9.200 AB	8.033 A	171.8 AB	179.1 AB	200.3 ABC	209.8 AB
5	El-Minofia	47.07 A	50.03 A	8.967ABC	7.700 A	154.8 D	164.2 B	181.9 E	191.2 CD
6	El-Fayum	37.43 BC	38.87 BC	7.767 C	6.933 A	153.9 D	167.7 B	180.6 E	191.7 CD
7	El-Giza	47.17 A	51.73 A	9.267 AB	8.300 A	166.3 BC	178.2 AB	200.6 ABC	208.9 AB
8	El-Minia	45.37 AB	48.43 AB	8.967ABC	7.900 A	165.9 BC	181.5 AB	197.7ABCD	209.7 AB
9	El-Dakhalia	35.53 C	38.77 BC	8.467ABC	7.400 A	174.8 A	178.1 AB	202.8 AB	214.7 AB
10	El-Kaluobia	43.37 ABC	50.63 A	8.567ABC	7.800 A	162.1 CD	165.5 B	191.5BCDE	206.3ABC
CV (%)		11.42	11.53	7.73	10.35	2.83	5.41	4.19	4.26

Mean followed by the same letter(s) are not significantly different at the 5% level of probability

Table 3: Plant stem length (cm), Duration of harvest period (days), Harvest Index and Productivity Score of the ten studied accessions of cabbage during 2010- 2011 season.

Code No.	Genotypes of Cabbage	Plant stem length (cm)		Duration of harvest period (days)		Harvest Index		Productivity Score	
		2010	2011	2010	2011	2010	2011	2010	2011
1	Sohag	23.07 CD	24.60ABC	61.93 A	63.93 AB	87.50 A	87.13 A	106.3 AB	103.8 A
2	Bani-Sweaf	22.77 CD	26.37 AB	58.53 A	62.77 AB	88.60 A	89.77 A	105.7 AB	104.9 A
3	El-Sharkia	29.10 AB	28.50 A	68.30 A	57.03 AB	89.00 A	87.17 A	109.2 A	103.9 A
4	Assuit	27.57ABC	28.23 A	57.20 A	61.80 AB	85.33 A	87.33 A	105.4 AB	104.6 A
5	El-Minofia	21.70 D	22.47 BC	54.60 A	54.47 AB	88.73 A	90.93 A	107.9 A	107.1 A
6	El-Fayum	22.77 CD	26.03ABC	54.03 A	48.63 AB	85.97 A	87.50 A	102.8 B	102.4 A
7	El-Giza	24.03BCD	25.20ABC	69.50 A	61.87 AB	89.10 A	88.87 A	108.8 A	106.5 A
8	El-Minia	25.17BCD	27.93 AB	64.13 A	60.70 AB	89.00 A	86.60 A	108.0 A	103.7 A
9	El-Dakhalia	30.67 A	25.80ABC	56.93 A	57.13 AB	86.37 A	87.47 A	104.8 AB	103.3 A
10	El-Kaluobia	24.93BCD	25.53ABC	59.37 A	69.00 A	88.03 A	89.20 A	106.3 AB	105.7 A
CV (%)		4.19	11.39	11.40	18.05	3.13	2.92	2.33	3.17

Mean followed by the same letter(s) are not significantly different at the 5% level of probability

while, "El-Dakhalia" ecotype gave the lowest Gross Yield. As well as "El-Sharkia" and "El-Giza" ecotypes had the highest Marketable head weight, while, "El-Fayum" ecotype produced the lowest Marketable head weight.

"El-Fayum" and "El-Minofia" ecotypes were the earliest to 50% head formation (i.e took fewest number of days to 50% head formation), while "El- Sharkia" ecotype was the latest (i.e took the longest time to 50% head formation).

Cabbage entries also, differed significantly in their life cycle expressed in number of days to harvest time. "El-Sharkia" Ecotype took the highest number of days to harvest while; "El-Fayum" and "El-Minofia" ecotypes took the lowest number of days to maturity and ending their life cycle.

As shown in Tables 3 significant differences were found among cabbage entries in both seasons for Plant stem length. "El-Sharkia" accession plants showed the longest stem, while "El-Minofia" accession plants showed the shortest stem.

Significant differences were found among cabbage entries only in the second season for days of harvest period. "El-Fayum" accession had the fewest days of harvest period, while the greatest days of harvest period was recorded for "El-Giza" and "El- Kaluobia" accessions.

Significant differences were found among cabbage entries only in the first season for Productivity score. "El-Sharkia", "El-Minofia" and "El-Giza" accessions had the highest Productivity Score value, while the least Productivity Score was recorded for "El-Fayum" accession.

Harvest Index in both seasons did not show marked differences among accessions, although "Assuit" accession gave the lowest mean value and "El-Minofia" accession had the lowest mean value.

Our investigation along with previous studies of local cabbage landraces/ accessions [1, 11-13, 19-23] seems to be in well agreement on the notion of needs for breeding efforts. Deterioration in crop productivity and head quality of these predominantly open pollinated species could be attributed to seed production by unaware local farmers [24]. Farmers are practicing negative selection as they usually save seeds from unmarketable head remaining at the end of harvest season on inferior plant segregates. However, landrace/accession germplasm may still be useful as they would possess adaptation to prevailing biotic and/or abiotic local complex environment. It would be advised then to breed via introgression of desirable traits of "El-Sharkia" and "El-Fayum" into local landrace/accession genomes.

CONCLUSION

"El-Sharkia" may directly be adopted in the production system in Sohag and other regions of similar conditions as a high yielding cultivar. Both "El-Sharkia" and "El-Fayum" are nominated germplasm for breeding programs to improve productivity, quality and earliness of the studied Egypt local cabbage accessions.

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