YIELD AND HORTICULTURAL CHARACTERS EVALUATION OF SOME RADISH CULTIVARS UNDER UPPER EGYPT CONDITIONS

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Abstract: Fifteen radish cultivars were evaluated for yield and some of horticultural characters at the Experimental Farm, Faculty of Agriculture, Sohag, South Valley University. The performance of these cultivars was found to be different. Cultivars showed a wide range of variation in most of studied traits. New White Chinese cultivar gave the highest root fresh weight, leaves fresh weight, whole plant fresh weight, root total yield and whole plant total yield, while Red Prince cultivar gave the lowest values for these traits. White Icicle cultivar gave the highest value for Root/Whole plant % trait, while Crimson Giant cultivar produced the lowest value for this character. Seed germination percentage under different salinity condition was estimated.

Key words: yield, horticultural, radish.

Introduction

In Egypt, radish (*Raphanus sativus* L.) is popular vegetable consumed mainly fresh in salad. White radish is more common in Egypt than the red one. Cultivars of both white and red radish cultivated in Egypt are low in quality characters. Radish is very popular in the African and Asian regions and widely grown as a mono crop or intercrop (Knott, 1950; Splittstoesser, 1984; Thompson and Kelly, 1957). Radish has a long history. It was eaten in Egypt from the beginning of civilization. According to 'Herodotus' records, builders of the Great Pyramid ate enormous quantities of radish together with onion and garlic (Lovelock, 1972). Radish is one of the vegetables that can be grown in all agro ecological regions throughout the year if adequate moisture is available. Radish is also used as a local medicine. Lovelock, 1972, revealed that radish has been used in many of medicine treatment purposes. Radishes are a good source of vitamin C, and have only 100 calories per pound. It is very rich in minerals and vitamin A and C (Choudhury, 1967; Lovelock, 1972; Yamaguchi, 1983). It is a favorite crop in the home garden, because it is easily grown and harvestable in 3 to 6 weeks from seed sowing (Nonneke, 1989; Thompson and Kelly, 1957). For a long time no studies have been carried out to select or improve the

local radish cultivars. Many testing trails of radish has been investigated by many researchers (Simao, 1960; Arora and Pondey, 1969; Gruniceva, 1970; Shinohara, 1980; Bahaa El-Din *et al*., 1984; Huaming, 1991; Perera, 1993; Guiwen, 1995; Maoliang, 1995; Bhat, 1996; Qin, 1996; Fang, 1996; Rawhia *et al*., 1998; Bonasia *et al*., 2001; Singh and Rajodia, 2001; Zavala and Botto, 2002; Rawhia and Salwa 2004). In the present study, 15 radish cultivars were tested and evaluated for two years to find acceptable and good radish cultivars for local consumption in Upper Egypt. The purpose of the experiment was to evaluate the yield and horticultural characters of these radish cultivars in order to select the cultivar most suited for the Upper Egypt.

Materials and Methods

Fifteen different cultivars of radish (*Raphanus sativus* L.) were evaluated in this study. Root color, maturity and the source of these 15 radish cultivars are listed in Table (1). The experiment was carried out in the Experimental Farm of Faculty of Agriculture, Sohag, South Valley University during 2003/2004 and 2004/2005 winter seasons, where the soil was sandy calcareous (surface layer contains transported Nile sediments over desert soil). Color and shape of root and the leaves of these cultivars are presented in Figure (1). A Randomized Complete Block Design (RCBD) with four replications was used in the trial. Seeds were sown directly to the field on the 2nd week of October in both successive years. Seeds were sown on both sides of 60 cm ridges in 3×3.5 m^2 plots. The distance between plants was 5cm in the red cultivars and 10cm in the white ones. Thinning was done to keep 1 plant per hill, after 2 weeks of sowing. The early cultivars were harvested after 30-40 days, while the late cultivars were collected after 60-80 days. All agricultural practices and plant protection measures were followed as per recommendations.

Recorded Data:

The following data were collected:

A random sample of 10 plants was taken from each plot to measure the following characters:

1- Root fresh weight (g)

2- Leaves fresh weight (g)

3- Whole plant fresh weight (g)

4- Root /Whole plant%

5- Total root weight (ton/fed)

6- Total Plant weight (ton/fed)

7- Seed germination % under salinity condition (0, 1000 and 2000 ppm of NaCl).

Data obtained were statistically analyzed and treatments means were compared using the Duncan's Multiple Range Test according to (Gomez and Gomez, 1984)

Table(1): Root color, maturity date and source for fifteen radish Cultivars.

Code No.	Cultivars	Root color	Maturity	Source
1	Red Prince *	Red	30-40 days	L.L.Olds Seed Co., USA
2	Crimson Giant *	Red	30-40 days	L.L.Olds Seed Co., USA
3	Red Baron *	Red	30-40 days	Northrup King Co., USA
4	White Globe Hailstone*	White	30-40 days	L.L.Olds Seed Co., USA
5	Comet *	Red	30-40 days	L.L.Olds Seed Co., USA
6	Early Scarlet Globe *	TR/BW [+]	30-40 days	L.L.Olds Seed Co., USA
7	Sparkler *	TR/BW	30-40 days	L.L.Olds Seed Co., USA
8	Round Black Spanish**	Black	60-80 days	L.L.Olds Seed Co., USA
9	New white Chinese**	White	60-80 days	L.L.Olds Seed Co., USA
10	China Rose **	Rose	60-80 days	L.L.Olds Seed Co., USA
11	White Icicle *	White	30-40 days	L.L.Olds Seed Co., USA
12	Cherry Belle *	Red	30-40 days	L.L.Olds Seed Co., USA
13	French Breakfast *	TR/BW	30-40 days	L.L.Olds Seed Co., USA
14	Champion *	Red	30-40 days	Island Seed Co., USA
15	Balady *	White	30-40 days	Local (E.A.O)[++]

* Early cultivars ** Late cultivars

[+] TR= Top red, BW= Bottom white [++] EAO, Egyptian Agricultural Organization

Figure(1): Radish cultivars plant (root and leaves of plants after 6 weeks growth in the field). Plants are phenotypically different in both color and shape of root and growth of leaves.

Results and Discussion

1- Root fresh weight (g)

Data illustrated in Table (2, A) clearly revealed that root fresh weight was significantly affected by cultivar. The highest value of root fresh weight in both seasons was recorded by New white Chinese cultivar (129.9 g) followed by China Rose and Round Black Spanish cultivars (111.7 and 111.6 g), respectively. However there were no significant differences between China Rose and Round Black Spanish cultivars. While, Red Prince cultivar showed the lowest value for this trait (45.03 g) followed by French Breakfast and Cherry Belle cultivars (45.81 and 46.00 g), respectively, and there were no significant differences among these cultivars in both seasons. These results were similar with those obtained by Huaming, 1991, Perera, 1993, Guiwen, 1995 and Qin, 1996.

2- Leaves fresh weight (g)

The result of this trait is presented in Table (2, B). Tested cultivars showed a wide range of variation in this experiment. In both seasons, New white Chinese cultivar gave the highest value for this trait (261.4 g) followed by China Rose and Crimson Giant cultivars (201.4 and 167.8 g), respectively. However there were significant differences among these cultivars. Whilst, Red Prince cultivar gave the lowest value for this character (13.58 g), followed by White Icicle and Comet cultivars (21.20 and 22.61 g), respectively, and there were no significant differences between White Icicle and Comet cultivars.

Table(2): Root and leaves fresh weight (g) of fifteen radish cultivars.

Code No.	Cultivars	A- Root fresh weight (g)			B- Leaves fresh weight (g)		
		2004	2005	Mean	2004	2005	Mean
1	Red Prince	45.43 m	44.64 kl	45.03 L	13.57 m	13.59 m	13.58 N
2	Crimson Giant	64.63 h	44.33 l	54.48 I	167.6 c	168.0 c	167.8 C
3	Red Baron	57.75 i	57.44 h	57.60 H	150.8 d	156.6 d	153.7 D
4	White Globe Hailstone	82.92 f	86.76 e	84.84 E	46.42 g	46.44 g	46.43 G
5	Comet	53.20 j	52.89 i	53.04 J	20.36 l	24.86 k	22.61 LM
6	Early Scarlet Globe	49.01 k	50.00 j	49.51 K	36.77 h	36.58 h	36.67 H
7	Sparkler	94.83 d	90.18 d	92.51 C	56.55 f	54.57 f	55.56 F
8	Round Black Spanish	110.34 c	112.9 b	111.6 B	62.11 e	64.74 e	63.42 E
9	New white Chinese	125.44 a	134.4 a	129.9 A	253.6 a	269.3 a	261.4 A
10	China Rose	115.70 b	107.6 c	111.7 B	194.0 b	208.7 b	201.4 B
11	White Icicle	85.64 e	86.99 e	86.32 D	21.16 l	21.24 l	21.20 M
12	Cherry Belle	47.34 l	44.66 kl	46.00 L	23.82 k	25.70 jk	24.76 K
13	French Breakfast	45.68 m	45.93 k	45.81 L	23.57 k	22.65 kl	23.11 L
14	Champion	67.03 g	67.93 f	67.48 F	28.46 j	28.55 ij	28.50 J
15	Balady	64,72 h	61.50 g	63.11 G	30.82 i	31.32 i	31.07 I
	Mean	73.98 A	72.55 B		75.31 B	78.19 A	

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

3-Whole plant fresh weight (g)

It is clear from data illustrated in Table (3, A) that the fresh weight of whole plant was significantly affected by tested cultivars. New white Chinese cultivar significantly gave the highest value (391.2 g) for this character followed by China Rose and Crimson Giant cultivars (313.3 and 220.6 g), respectively. While, the lowest fresh weight of whole plant produced by Red Prince cultivar (58.61 g) followed by French Breakfast and Cherry Belle cultivars (69.05 and 70.91 g), respectively and there were significant differences among these cultivars.

4- Root / Whole plant (%)

It is clear from data shown in Table (3, B) that the root/whole plant significantly affected by tested varieties under the experimental conditions. White Icicle cultivar gave the highest value for this trait (80.12%) followed by Red Prince, Comet and Champion cultivars (76.84, 79.39 and 70.18 %), respectively, and there were no significant differences between Comet and Champion cultivars. Whilst, Crimson Giant cultivar produced the lowest value (24.52%) followed by Red Baron, New white Chinese and China Rose cultivars (27.28, 33.21 and 35.66%) respectively, and there were significant differences among these cultivars.

Table(3): Whole plant fresh weight (g) and root/whole (%) of fifteen radish cultivars.

Code No	Cultivars	A-Whole plant fresh weight (g)			B- Root / whole (%)		
		2004	2005	Mean	2004	2005	Mean
1	Red Prince	59.00 m	58.23 n	58.61 N	77.01 b	76.67 b	76.84 B
2	Crimson Giant	232.2 c	209.0 d	220.6 C	27.83 l	21.21 k	24.52 L
3	Red Baron	208.3 d	214.1 c	211.2 D	27.72 l	26.83 j	27.28 K
4	White Globe Hailstone	129.0 g	133.2 g	131.1 G	64.26 g	65.14 f	64.70 E
5	Comet	73.56 k	77.75 l	75.65 K	72.32 c	68.04 d	70.18 C
6	Early Scarlet Globe	85.78 j	86.58 k	86.18 J	57.13 i	57.76 h	57.45 H
7	Sparkler	151.0 f	144.8 f	147.9 F	62.80 h	62.30 g	62.55 G
8	Round Black Spanish	172.7 e	177.7 e	175.2 E	63.90 g	63.56 g	63.73 F
9	New white Chinese	378.8 a	403.7 a	391.2 A	33.12 k	33.29 i	33.21 J
10	China Rose	310.2 b	316.4 b	313.3 B	37.30 j	34.02 i	35.66 I
11	White Icicle	107.3 h	108.2 h	107.7 H	79.85 a	80.38 a	80.12 A
12	Cherry Belle	71.46 kl	70.36 m	70.91 L	66.25 f	63.49 g	64.87 E
13	French Breakfast	69.52 l	68.58 m	69.05 M	65.71 f	66.98 de	66.35 D
14	Champion	95.26 i	96.48 i	95.87 I	70.36 d	70.42 c	70.39 C
15	Balady	95.84 i	92.82 j	94.33 I	67.53 e	66.27 ef	66.90 D
	Mean	149.3 B	150.5 A		58.21 A	57.09 B	

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

5- Root total yield (ton/fed)

The data obtained in Table (4, A) clearly indicated that varieties significantly affect root total yield under the experimental conditions. New white Chinese cultivar gave the highest value (7.795 ton fed) followed by China Rose, Round Black Spanish and Sparkler cultivars (6.702, 6.698 and 5.550 ton/fed) respectively, and there were no significant differences between China Rose and Round Black Spanish cultivars. Whilst, Red Prince cultivar gave the lowest value (2.703 ton/fed) followed by French Breakfast and Cherry Belle cultivars (2.748 and 2.760 ton/fed), respectively, and there were no significant differences among these cultivars. These results were in line with those found by Huaming, 1991, Perera, 1993, Guiwen, 1995, and Qin, 1996.

6- Whole plant total yield (ton/fed)

Data obtained in Table (4, B) obviously showed that the varieties significantly affect whole plant total yield under the condition of experiment. New White Chinese cultivar gave the highest value (23.48 ton/fad) followed by China Rose and Crimson Giant cultivars (18.80 and 13.24 ton/fed), respectively, and there were no significant differences among these cultivars. The lowest values resulted from Red Prince cultivar (3.518 ton/fad) followed by French Breakfast and Cherry Belle cultivars (4.142 and 4.255 ton/fed), respectively, and there were no significant differences among these cultivars. Similar trends were reported by Perera, 1993, Guiwen, 1995, and Qin, 1996.

Table(4): Root and whole plant total yield (ton/fed) of fifteen radish cultivars.

Code No	Cultivars	A- Root total yield (ton/fed)			B- Whole plant total yield (ton/fed)		
		2004	2005	Mean	2004	2005	Mean
1	Red Prince	2.727 m	2.680 k	2.703 L	3.540 m	3.497 n	3.518 N
2	Crimson Giant	3.880 h	2.660 k	3.270 I	13.93 c	12.54 d	13.24 C
3	Red Baron	3.463 i	3.447 h	3.455 H	12.50 d	12.84 c	12.67 D
4	White Globe Hailstone	4.977 f	5.207 e	5.092 E	7.743 g	7.993 g	7.868 G
5	Comet	3.193 j	3.173 i	3.183 J	4.413 k	4.663 l	4.538 K
6	Early Scarlet Globe	2.940 k	3.000 j	2.970 K	5.147 j	5.193 k	5.170 J
7	Sparkler	5.690 d	5.410 d	5.550 C	9.060 f	8.687 f	8.873 F
8	Round Black Spanish	6.620 c	6.777 b	6.698 B	10.36 e	10.66 e	10.51 E
9	New white Chinese	7.527 a	8.063 a	7.795 A	22.73 a	24.22 a	23.48 A
10	China Rose	6.943 b	6.460 c	6.702 B	18.61 b	18.98 b	18.80 B
11	White Icicle	5.137 e	5.220 e	5.178 D	6.437 h	6.493 h	6.465 H
12	Cherry Belle	2.840 l	2.680 k	2.760 L	4.287 kl	4.223 m	4.255 L
13	French Breakfast	2.740 m	2.757 k	2.748 L	4.171 l	4.113 m	4.142 M
14	Champion	4.020 g	4.077 f	4.048 F	5.713 i	5.787 i	5.750 I
15	Balady	3.883 h	3.690 g	3.787 G	5.747 i	5.570 j	5.658 I
	Mean	4.439 A	4.353 B		8.959 B	9.031 A	

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

7- Seed germination % under salinity condition

Data illustrated in Table (5) clearly revealed that seed germination % under salinity condition was significantly affected by cultivar. There were no significant differences among all cultivars under control (0 ppm), while there were significant differences among all cultivars under the low and high levels of salt concentration (1000 and 2000 ppm). White Icicle cultivar was the best in seed germination (100%) under the low level of salt concentration (1000 ppm), while Balady cultivar was the best in seed germination (96.60%) under the high level of salt concentrations (2000 ppm). Balady cultivar was the best in seed germination under the all levels of salt concentration (98.07%), while Red Baron cultivar was the worst in seed germination under the all levels of salt concentration (44.37%).

Table(5): Seed germination percentage under different salinity conditions of fifteen radish cultivars.

Code No	Cultivars	Seed Germination (%)			
		Control (0 ppm)	Low salt (1000 ppm)	High salt (2000 ppm)	Mean
1	Red Prince	100. a	66.30 fg	34.90 jk	67.07 F
2	Crimson Giant	100.0 a	94.00 abc	56.27 h	83.42 C
3	Red Baron	100.0 a	23.63 l	9.48 m	44.37 H
4	White Globe Hailstone	100.0 a	91.67 abc	71.97 ef	87.88 B
5	Comet	99.60 a	74.00 ef	28.67 kl	67.42 F
6	Early Scarlet Globe	100.0 a	90.10 bc	69.20 fg	86.43 BC
7	Sparkler	100.0 a	71.30 ef	24.10 l	65.13 F
8	Round Black Spanish	99.30 ab	98.70 ab	61.17 gh	86.39 BC
9	New white Chinese	100.0 a	86.60 cd	51.93 hi	79.51 D
10	China Rose	100.0 a	79.00 de	41.50 j	73.50 E
11	White Icicle	100.0 a	100.0 a	87.00 cd	95.67 A
12	Cherry Belle	100.0 a	97.20 ab	94.10 abc	97.10 A
13	French Breakfast	100.0 a	96.00 abc	91.67 abc	95.89 A
14	Champion	99.30 ab	44.00 ij	31.77 kl	58.36 G
15	Balady	99.60 a	98.00 ab	96.60 ab	98.07 A
	Mean	99.85 A	80.70 B	56.69 C	

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

Conclusion

From the data presented in this study, it could be concluded that: (1) New white Chinese cultivar was the best in most of studied traits. (2) White Icicle cultivar was the best in Root/Whole plant (%) and seed germination under the low level of salt concentrations (1000 ppm). (3) Balady cultivar was the best in germination under the high levels of salt concentrations and the all levels of salt concentrations. Results of this study revealed that some of white and red foreign radish cultivars such as New White Chinese, White Icicle and China Rose can be introduced to grow in Upper Egypt.

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تقييم الصفات المحصولية والبستانية لبعض أصناف الفجل تحت ظروف مصر العليا

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تم تقييم خمسة عشر صنفا من الفجل بالنسبة للمحصول وبعض الصفات البستانية الأخرى فى المزرعة البحثية لكلية الزراعة بسوهاج جامعة جنوب الوادى .

ويمكن تلخيص أهم النتائج فيما يلي:

- أظهرت النتائج أن هناك تباينا واسعا وكبيرا بين هذه ألأصناف فى معظم الصفات المدروسة.

- فقد أعطى الصنف نيو هوايت شاينيز أعلى القيم بالنسبة لصفات : وزن الجذور الطازج ، وزن الأوراق الطازج ، الوزن الكلى للنبات الطازج ، الوزن الكلى لمحصول الجذور ، الوزن الكلى لمحصول للنبات، بينما أعطى الصنف رد برنس أقل القيم بالنسبة لهذه ا لصفات.

- أما الصنف هوايت أيسكل فقد أعطى أعلى القيم بالنسبة لصفة وزن الجذور/ الوزن الكلى للنبات، بينما أظهرالصنف كرمسون جاينت أنه صاحب أقل القيم لهذه الصفة.

- واخيرا الصنف البلدى كان أحسن ألأصناف إنباتا تحت كل مستويات الملحية ، بينما الصنف رد بارون كان أقل ألأصناف إنباتا تحت جميع مستويات الملحية.