



Yield and yield components, morphological and quality characteristics of Aromatik-1 rice variety: the first aromatic rice in Turkey

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ABSTRACT

Aromatic rice (*Oryza sativa* L.) has high quality aroma with cooking quality. This study was carried out in order to select aromatic rice with introduction of nurseries from IRRI (International Rice Research Institute) at Trakya Agricultural Research Institute between 1999 to 2004. The materials were tested for primary yield, yield and regional yield trials. As a result of these trials, YRF-204 aromatic rice line was evaluated for yield, yield components, morphological and quality characteristics in registration trials in 2005 and registered as Aromatik-1 in 2007. Aromatik-1 variety has high yield and aromatic characteristics. Aromatik-1 had 13 (104 days after sowing) and 12 days (149 days after sowing) later to flowering and maturity than that of Baldo (91 days after sowing) and (137 days after sowing), respectively. Aromatik-1 had 5.11 % more yield than the check cultivar Baldo over means of 5 year experiments from 2000 and 2004, while it had less (52 %) head rice yield than that of Baldo (55 %). Although Aromatik-1 rice cultivar is indica type rice, 52 % head rice is very good for this type of rice. Aromatik-1 variety was the first aromatic rice registered in Turkey for yield, some morphological and quality characteristics. The present study shows that yield and quality parameters in rice as Aromatic-1 variety could be improved via traditional breeding methods.

Keywords: aromatic rice, *Oryza sativa*, quality, yield

Introduction

Aroma represents high quality in rice (*Oryza sativa* L.), and cooking quality and head rice yield have close relations with aroma (Nagaraju et al. 1975, Tripathi and Rao 1979). On the other hand, aromatic rices have less yield and more susceptibility to diseases and pests than the other rice (Berner and Hoff 1986). Although they had lower yield, researchers in Europe studies to improve aromatic rice for Europe (Lorieux et al. 1997). There are various ideas about inheritance of aroma in rice. Some researchers reported that it was governed by a single gene, some researchers reported that it was under more genes than one gene inheritance. Main component responsible for aroma in rice is 2-acetylpyroline (AcPy), and this component was found in

every part of rice plant except in roots (Buttury et al. 1983).

Rice production area in Turkey ranged from 40 000 ha to 100 000 ha during last 50 years. Annual total milled rice production were between 150 000 and 500 000 Metric Tons and this production is not sufficient for domestic consumption in Turkey. Turkey self sufficiency for rice was 43% in 2000, it increased to more than 90,7 % in 2010. There is a need to improve rice production nearly 10 % to be self sufficient in Turkey. Turkey can be 100 % self sufficient for rice in near future. But there was no any aromatic or basmati type rice production until 2007. Despite import of small amount of aromatic rice each year, it will be continued to import if aromatic rice is not registered for Turkey. .

Table 1. Paddy yield of rice genotypes for 2000, 2001 and 2002

Primary yield trial, 2000		Yield trial, 2001		Yield trial, 2002	
Genotypes	T/ Ha	Genotypes	T/ Ha	Genotypes	T/ Ha
Rocca (st)	5.82	Demir (st)	8.84	BALDO (St)	627
YRF-204	5.69	Rocca (st)	7.89	YRF-204	569
Osmancik-97 (st)	7.19	YRF-204	7.44	YAR-96-V14	537
IR 70444-87-2-1	4.18	Kıral (st)	6.84	YRF-203	526
YAR-96-v14	4.26	Osmancik-97 (st)	6.62	IR0445-229-4-1	523
IR70422-51-3-2	4.96	IR 70444-87-2-1	6.53	JJ92(ADT41)	471
IR-70422-66-5-2	5.33	YAR-96-v14	6.24	RAJBHOG	426
IR-70422-105-3-3	4.34	IR70422-51-3-2	6.08	IR66233-151-1-1	415
Baldo (st)	6.67	IR-70422-66-5-2	6.07	IR70422-51-3-2	414
YRF-203	5.01	IR-70422-105-3-3	5.82	IR70445-5-2-2	403
IR70416-53-2-2	3.88	Baldo (st)	5.72	IR0422-105-3-3	385
IR70086-3-3-1-3	3.33	YRF-203	5.71	IR70422-66-5-2	385
IR70086-19-1-2-2	4.20	IR70416-53-2-2	5.45	IR70416-53-2-2	384
IR66696-55-2-2-3	3.58	IR70086-3-3-1-3	5.23	IR70422-152-1-1	330
RAJBHOB	4.11	IR70086-19-1-2-2	4.87	IR70086-19-1-2-25	329
IR70423-170-2-3	2.71	IR66696-55-2-2-3	4.76	IR70086-3-3-1-2	304
RP3138-42-11-7-1	1.26	RAJBHOB	4.75	IR66696-55-2-2-3	282
IR670-228-1-5	2.38	IR70423-170-2-3	4.57		
IR67420-228-1-5	1.89	RP3138-42-11-7-1	4.44		
IR70418-112-1-2	1.10	IR670-228-1-5	4.12		
IR67414-216-3-4-2-3	1.61	IR67420-228-1-5	4.09		
IR70421-188-2-1	1.24	IR70418-112-1-2	3.93		
		IR67414-216-3-4-2-3	2.96		
		IR70421-188-2-1	2.89		
C.V(%)	16	C.V(%)	17.3	C.V(%)	12.5
LSD (5%)	1.36	LSD (5%)	3	LSD (5%)	1.61
			1.56		

All rice varieties grown in Turkey are non aromatic japonica type rice. Aromatic and basmati type varieties were not produced in Turkey (Beşer et al. 2007). Aromatic type rice is more expensive than japonica rice. For these reasons aromatic rice breeding project has been started in Turkey in 2007. In this paper, results pertaining to performance of Aromatik-1 rice cultivar, which is the first registered aromatic rice in Turkey, for yield, morphological and quality characteristics are presented.

Materials and methods

Preliminary studies were started in 1999 with introduction of International Rice Fine Grain Aromatic Rice Observation Nursery (IRFAON -1999) from IRRI (International Rice Research Institute). In 1999, IRFAON 1999 nursery was raised in augmented design. Each line was planted at 5 m². More materials were continued to introduce during later years from IRRI. Introduced materials were tested at screening nurseries, primary yield, yield and regional yield trials between 2000 and 2004. Primary yield trial was conducted with three replications and each line was planted at 8 m² plots. Yield and regional yield trials were conducted at 4 x 5 m (20 m²) plots with

three replications. Since there was not any registered aromatic type and indica type rice variety in Turkey during this research, japonica type best local checks for grain quality such as Baldo, Kıral and high yielding varieties such as Osmancik-97, Rocca and Demir were used as checks for different years in yield trials. Except the mentioned local checks, a japonica type aromatic rice, Rajbhob was also used as check. Experiments were fertilized with P₂O₅ of 80 kg/ ha and N of 150 kg/ha each year. All phosphorus was applied before sowing, nitrogen was applied at three times 1/3 part was applied at before sowing, while 1/3 part was applied at tillering stage and other 1/3 part was applied at panicle initiation.

Screenings were taken according to Standard Evaluation System for Rice (Anonymous 1996). Yield and other characters such as plant height, panicle length, days to flowering, days to maturity, panicle sterility, 1000-kernel weight, brown rice yield (%), total milled rice yield (%), and head rice yield were recorded.

Results and discussion

Experimental results for yield are given for five years from 2000 to 2004 in Table 1 and Table 2.

YRF-204 (Aromatik-1) had 2nd, 3rd, 2nd, 2nd, 2nd and 4th place at primary yield trial in 2000, yield trial in 2001, yield trial in 2002, regional yield trial in 2002, yield trial in 2003 and yield trial in 2004, respectively. YRF-204 was adapted very well for Turkey climatic conditions. Baldo or this type rice is accepted the

highest quality rice in Turkish rice market and it is sold at the highest price. As can be seen from Table 3, YRF-204 (Aromatik-1) had 5.11 % more yield than the Baldo rice for 5 years mean from 2000 and 2004. From these results, Aromatik-1 rice cultivar can be grown competitively by Turkish rice producer.

Table 2. Paddy yield of rice genotypes for 2002, 2003 and 2004

Regional yield trial, 2002		Yield trial, 2003		Yield trial, 2004	
Genotypes	T/ Ha	Genotypes	T/ Ha	Genotypes	T/ Ha
OSMANCIK-97	7.93	YAR-96-V14	5.67	Baldo (st)	5.53
YRF-204	7.29	YRF-204	5.04	IR 70422-152-1-1	5.46
YAR-96-V14	6.73	Baldo (st)	4.04	YAR-96-V14	5.07
BALDO (st)	5.82	RAJBHOG	3.20	YRF-204	4.73
YRF-203	4.61	IR 70422-51-3-2	3.07	IR 0445-229-4-1	4.72
IR70422-51-3-2	4.33	IR 66696-55-2-2-3	2.94	IR 70445-5-2-2	4.29
IRO422-105-3-3	4.13	IR 0445-229-4-1	2.92	IR 66232-274-1-3-2	4.24
IR70086-19-1-2-2	4.00	IR 70416-53-2-2	2.91	IR 71743-32-2-1	4.08
IR70422-66-5-2	3.38	YRF-203	2.88	YRF-203	3.58
IR70086-3-3-1-3	3.21	IR 70086-3-3-1-2	2.72	IR 66233-151-1-1	3.49
IR70416-53-2-2	3.00	JJ92 (ADT41)	2.45	IR 70422-51-3-2	3.40
IR70444-87-2-1	2.96	IR 70422-152-1-1	2.28	IR 70086-3-3-1-2	3.04
IR66696-55-2-2-3	2.19	IR 70086-19-1-2-25	2.23	JJ92 (ADT41)	2.97
		IR 70445-5-2-2	2.05	IR 70416-53-2-2	2.96
		IR 71743-32-2-1	1.73	RAJBHOG	2.90
		IR 67014-138-3-1	1.70	IR 70086-19-1-2-25	2.20
		IR 67013-76-2-3-3	1.32	IR 66696-55-2-2-3	1.75
		IR 66233-151-1-1	1.14	DR 31	1.58
				IR 67014-138-3-1	1.46
				IR 67013-76-2-3-3	1.10
				Azucena	0.76
C.V(%)	12.5	C.V(%)	31.78	C.V(%)	12.62
LSD (5%)	0.97	LSD (5%)	1.48	LSD (5%)	0.69

Table 3. Paddy yields of Aromatik-1 and Baldo varieties between 2000 and 2004, and mean yield differences of Aromatik-1 variety from check variety Baldo

	Paddy yield T/ ha, between 2000 and 2004						Mean Yield T/ Ha	Mean yield differences from check (%)
	2000	2001	2002	2002	2003	2004		
Baldo (Check)	6.67	5.72	6.27	5.82	4.04	5.53	5.67	-
Aromatik-1	5.69	7.44	5.69	7.2	5.04	4.73	5.96	5.11

Table 4. Some quality characteristics of Aroamtik-1 and Baldo varieties

Genotype	Paddy kernel length (L) and width (W) (mm)		Polished rice kernel length (L) and width (W) (mm)		Milling yield (%)			Paddy 1000 kernel weight (g)
	L	W	L	W	Brown	Total	Head	
Baldo	9.3	3.7	6.9	3.2	79	70.3	55	38.8
Aromatik-1	9.4	2.4	6.9	2.1	82.1	70.2	52	23.7

Table 5. Some morphological and quality characteristic of rice genotypes in 2004

Lines/ cultivars	Days to flowering	Days to maturity	Plant height (cm)	Panicle length (cm)	Panicle sterility (%)	Paddy rice		Polished rice		1000 paddy kernel weight (g)
						Length (mm)	Width (mm)	Length (mm)	Width (mm)	
Baldo (st)	91	137	96.7	16.1	13.7	9.3	3.7	6.9	3.2	38.8
IR 66696-55-2-2-3	108	151	81.3	19.6	48.1	11.4	2.3	7.5	2.0	22.6
IR 70086-19-1-2-25	111	152	90.8	20.5	56.1	11.9	2.4	7.4	1.9	24.9
IR 70086-3-3-1-2	105	153	90.3	19.9	50.6	11.0	2.3	7.6	1.9	23.4
IR 70416-53-2-2	99	149	82.7	19.3	40.2	10.4	2.2	7.4	1.9	22.3
IR 70422-51-3-2	104	151	92.1	20.1	38.5	9.9	2.4	7.3	2.0	23.5
RAJBHOG	90	144	91.9	15.1	40.5	8.2	3.2	5.9	2.8	19.9
YAR-96-V14	94	151	69.9	16.0	27.6	9.9	2.7	6.9	2.3	26.0
YRF-203	104	155	88.9	17.7	47.0	9.6	2.6	7.0	2.2	23.6
YRF-204 (Aromatik-1)	100	149	79.7	17.9	30.7	9.4	2.4	6.9	2.1	23.7
IR 0445-229-4-1	105	155	80.5	18.7	46.1	9.3	2.3	7.5	2.0	23.6
IR 66233-151-1-1	104	152	90.4	21.1	36.1	11.3	2.2	8.1	1.8	25.2
IR 70422-152-1-1	100	151	83.7	19.2	48.6	9.2	2.1	6.6	1.9	20.5
IR 67014-138-3-1	113	156	74.4	19.9	67.8	11.2	2.3	7.7	1.9	22.7
JJ92 (ADT41)	112	155	90.3	23.2	61.0	10.8	2.3	7.3	1.9	25.2
IR 67013-76-2-3-3	122	158	72.7	15.9	83.8	10.2	2.2	7.0	1.9	20.8
IR 71743-32-2-1	112	156	79.6	16.9	63.1	11.0	2.2	7.1	1.8	21.3
IR 70445-5-2-2	103	156	84.8	21.5	41.4	10.4	2.3	7.5	1.9	21.1
Azucena	-	-	107.8	18.7	89.2	9.8	2.8	7.1	2.5	28.0
DR 31	116	159	73.0	19.3	62.3	9.7	2.5	6.8	2.1	22.3
IR 66232-274-1-3-2	116	155	76.3	19.9	61.4	11.4	2.2	7.4	1.9	24.5

Head rice yield is very important for Turkish market. As can be seen in Table 4, Aromatik-1 had 52 % head rice, while Baldo had 55 % head rice yield. Although Aromatik-1 rice cultivar is indica type rice, 52 % head rice is very good for this type of rice. It is nearly japonica type check Baldo cultivar for head rice rate. Results for some of the morphological and quality characteristics for 2004 are given in Table 5. Days to flowering (DTF) of YRF-204 (Aromatik-1) rice was recorded as 104 days, and its flowering time was later than that of Baldo rice with 91 days. Days to maturity (DTM) of YRF-204 (Aromatik-1) was 149 days and its days to maturity was 12 days later than that of Baldo. On the other hand, YRF-

204 (Aromatik-1) had short plant height and lodging resistant than the Baldo variety. 1000-kernel weight of YRF-204 (Aromatik-1) was smaller than that of Baldo.

As a result of five years experiments from 2000 to 2004, YRF-204 was identified to nominate for registration trial. After registration trials for two years, YRF-204 was registered as Aromatik-1 and started producing foundation seeds. Aromatik-1 has been produced by farmers as a first registered aromatic rice cultivars in Turkey. This study suggested that yield and related components and quality characteristics in rice could be improved via conventional breeding approaches.

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