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A Research to Determine The Suitable Rice (*Oryza sativa L.*) Harvesting Time

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Abstract: The objective of this study was to determine the suitable rice harvesting time to obtain high paddy yield and quality milled rice.

The experiment was conducted in a randomized split block design with four replications under continuous flood irrigation in 1988, 1989, and 1990. Three planting times were practiced at May 10, May 20; and May 30. Four harvesting times were applied at 35, 42, 49, and 56 days after flowering (DAF).

This study showed that maximum paddy yield and total milled rice, minimum berakage during milling, minimum unfilled and partially filled grains, acceptable moisture content, minimum chalky kernel in milled rice were obtained at 49 DAF. The early harvesting of rice causes both quantitative and qualitative losses. According to the results of present study, rice should be harvested 49 DAF in the Thrace part of Turkey. It may be one week earlier in the late planting. The variance analysis of data showed that there was no interaction between planting and harvesting times for field yield and total milled rice.

En Uygun Çeltik (*Oryza sativa L.*) Hasat Zamanının Belirlenmesi Üzerine Bir Araştırma

Özet: Bu araştırmanın amacı, yüksek çeltik verimi ve kaliteli pirinç elde etmek için, en uygun çeltik hasat zamanını belirlemektir.

Araştırma 1988, 1989 ve 1990 yıllarında dört tekerrürlü olarak tesadüf bloklarında bölünmüş parseller deneme deseninde devamlı sulama koşullarında gerçekleştirilmiştir. 10, 20 ve 30 Mayıs tarihlerinde yapılan üç ekim zamanı uygulanmıştır. Çiçeklenmeden 35, 42, 49 ve 56 gün sonraları yapılan 4 hasat zamanı gözönünde bulundurulmuştur.

Bu çalışmada, en yüksek tane verimi ve toplam pirinç randımanı, en düşük kırık oranı, en düşük boş veya kısmen dolu tane miktarı, kabul edilebilir nem oranı, en düşük ham pirinç miktarı, çiçeklenmeden 49 gün sonra yapılan hasatla elde edilmiştir. Daha erken hasatlar hem kalite, hemde kantite kayıplarına neden olmaktadır. Bu araştırmanın sonucuna göre, Türkiye'nin Trakya Bölgesinde, çiçeklenmeden 49 gün sonra çeltik hasat edilmelidir. Geç ekimlerde, hasat belki bir hafta daha erken yapılabilir. Yapılan varyans analizi, çeltik verimi ve toplam pirinç randımanı için hasat ve ekim zamanı arasında bir interaksyonun olmadığını göstermiştir.

Introduction

Rice growing period is 150-160 days from the first May to mid October in the northwestern part of Turkey. Thus, in order to obtain maximum rice yield and total milled rice, it is essential to sow and harvest it just on time. Early harvesting may reduce the field yield of paddy and head rice yield due to presence of immature kernels. Late harvesting may also reduce rice yield because of grain shattering and lodging.

The rice harvesting time is an important variable which determines the field yield, total and head yield of rice. Farmers decide their harvesting time by examining the percentage of ripened grains in the panicles. The crop should be ready to harvest when 80% of the panicles are straw-colored and the grains in the the lower portions of

the panicle are in the hard-dough stage. Farmers in some of southern and southeastern Asian countries usually harvest at maturity to minimize field losses resulting from shattering, overripe, and unfavorable weather (1). It was reported (2) that the optimum harvesting time for lowland rice was between 28 and 34 days after heading during the dry season, and between 34 and 38 days after heading during the wet season in the tropical areas.

In India, It was reported (3) that harvesting between 27 and 39 days after flowering at high moisture content (18-23%) gave maximum head rice recovery. Harvesting before or after that period is resulted increase of broken grains. In Japan, 20-25 days after heading was found the best time to harvest (4). In California, some rice growers reported high head rice yields harvesting at 22-26%

moisture and in Arkansas, rice is harvested at 18-22% moisture content (5).

Maximum paddy yield and total milled rice, minimum breakage during milling, acceptable moisture content, minimum green paddy in crop, and minimum chalky kernel in milled rice were obtained at 32 days after flowering in Bangladesh (6). Another similar result was reported by Shumten (7) in Pakistan, the optimum harvesting time is determined as 30-35 days after flowering and this time 80% of the grains turn into a yellow colour.

A study was conducted to determine the optimum harvesting period for rice in summer season in India (8). It was found that rice should be harvested 32-42 days after flowering (panicle moisture content 18-23%) to get the maximum field yield of paddy, and total and head yield of rice in India. Harvesting rice at 16-48 days after flowering, a research was carried out in the rainy season in West Bengal, India (9). The results of the experiment indicated that grain hardness and head yield were highest, and percentage of broken grains was lowest, when harvested at 32 days after flowering.

When rice was harvested 36-39 days after flowering at 20-30% moisture content in Pakistan (10), it gave high total milled and head rice recovery. Head rice recovery was low at both early and late maturity stages.

The objective of this study was to determine the suitable rice harvesting time to obtain high paddy yield and quality milled rice.

Materials and Methods

The experiment was conducted in a randomized split block design with four replications at the Thrace Agricultural Research Institute in 1988, 1989 and 1990. The main plot was planting times and subplot was harvesting time. The seed rate was 450 seeds/m² and fertilizer dose was N₁₅₀P₈₀ kg/ha, plot size was 4x5=20 m² at planting, and it was 3.5x4.5=15.75 m² at harvesting.

Rocca rice variety was used in this study. This is an Italian variety and matures at 135-140 days in the northwestern Turkey.

Three planting times were practiced (May 10, May 20 and May 30). Starting at 35 days after flowering with 7 day intervals, 4 harvesting dates were applied. Harvesting dates were at the 35, 42, 49 and 56 days after flowering (DAF).

Observations were recorded on paddy yield (tons/ha), 1000 grain weight, unfilled and partially filled grains, moisture content at harvesting, total milled rice, breakage, and chalky kernel.

Results and Discussion

The highest yield was obtained harvesting at 49 DAF with early planting time at May 10. However, there were no great differences among harvesting times in the late plantings. They almost gave the same amount of yields within in the same planting date (Table 3). On the contrary, the highest yields were obtained at 32 DAF in Bangladesh, India, and West Bengal, (6, 8, 9). The

Table 1. Mean values for different characters obtained from three planting times during the years 1988, 1989 and 1990.

Harvesting time (DAF)	Yield (Ton/ha)	Unfilled and partially filled grain (%)	Moisture content% at harvest	Total milled rice (%)	Breakage (%)	Chalky Kernel (%)	1000 grain weight (g)
May, 10	10.67 a	19.5 a	25.87	71.9 a	8.1 b	5.8 b	31.9 a
May, 20	8.55 b	20.1 a	26.72	71.5 b	9.9 a	7.2 a	30.7 b
May, 30	9.06 b	15.3 b	27.6	72.1 a	9.4 a	5.3 c	30.7 b
F Value=	38.8**	19.25**	-	5.134*	38.55**	66.79**	19.28**
LSD (0.05)=	0.591	1.768	-	0.395	0.655	0.346	0.329
CV(%)=	13.30	16.42	-	0.97	15.5	18.44	2.68

* and ** significant at 0.05 and 0.01 level respectively.

optimum harvesting time for lowland rice was between 28 and 34 DAF during dry season and between 34 and 38 DAF during the wet season in the tropical areas (2). The results of present study indicate that rice should be harvested 10 days later in the temperate regions than in the tropical areas due to cool climatical conditions during

grain ripping stage. Depending on the planting times, amount of the unfilled and partially filled grains decreased from 23.6-16.6% at 35 DAF to 19.3-14.1% at 56 DAF (Table 3). 1000 grain weight increased up to 49 DAF and the grain filling was completed by this time, after than there was slightly decrease in grain weight.

Table 2. Mean values for different characters obtained from four harvesting times during the years 1988, 1989 and 1990.

Harvesting time (DAF)	Yield (Ton/ha)	Unfilled and partially filled grain (%)	Moisture content% at harvest	Total milled rice (%)	Breakage (%)	Chalky Kernel (%)	1000 grain weight (g)
35	5.73 b	21.0 a	31.9	71.1 b	9.6 b	9.2 a	30.2 c
42	5.87 b	17.7 b	27.4	72.1 a	8.4 c	5.6 b	31.3 b
49	6.35 a	17.9 b	24.9	72.4 a	7.6 d	4.8 c	31.7 a
56	6.00 ab	16.7 b	22.8	72.0 a	10.9 a	4.8 c	31.2 b
F Value=	4.13**	13.596**	-	34.65**	16.64**	129.03**	19.28**
LSD (0.05)=	0.04	1.4	-	0.5	0.7	0.5	0.4
CV(%)=	13.3	16.4	-	1.0	15.5	18.4	2.7

* and ** significant at 0.05 and 0.01 level respectively.

Table 3. The average of the results obtained from four harvesting and three planting times in years 1988, 1989 and 1990.

Planting time	Harvesting time (DAF)	Yield (Tons/ha)	Unfilled and partially filled grain (%)	Moisture content% at harvest	Total milled rice (%)	Breakage (%)	Chalky Kernel (%)	1000 grain weight (g)
May, 10	35	6.48 bc	22.6 ab	31.7	71.5 d	8.4 d	7.4 d	31.0 cde
	42	6.48 bc	18.6 cd	27.8	72.1 abcd	8.3 d	5.5 de	32.1 ab
	49	7.31 a	20.2 bc	24.3	72.4 abc	5.9 e	5.2 de	32.4 a
	56	6.86 ab	16.7 def	19.7	71.8 bcd	10 bc	5.1 de	32.1 ab
May, 20	35	5.14 e	23.6 a	29.9	70.5 e	9.9 bc	10.4 a	30.4 ef
	42	5.28 de	18.4 cde	27.6	71.9 bcd	9.0 cd	6.4 c	30.9 cde
	49	5.88 cd	18.9 cd	25.1	72.0 bcd	8.5 d	5.9 cd	31.2 bc
	56	5.42 de	19.3 c	24.3	71.7 cd	12.1 a	5.9 cd	30.2 f
May, 30	35	5.56 de	16.6 def	34.0	71.4 de	10.5 b	9.8 a	29.3 g
	42	5.84 cd	16.1 efg	26.8	72.4 abc	7.9 d	4.8 e	30.8 def
	49	5.88 cd	14.5 fg	25.4	72.8 a	8.3 d	3.3 f	31.5 bc
	56	5.73 de	14.1 g	24.3	72.6 ab	10.5 b	3.4 f	31.3 cd
F Value=		0.573	2.314*		0.684	3.15**	9.7**	3.648**
LSD (0.05)=		0.06	2.4	-	0.8	1.2	0.9	0.7
CV(%)=		13.3	16.4	-	1.0	15.5	18.4	2.7

* and ** significant at 0.05 and 0.01 level respectively.

During the grain maturity, moisture content decreased continuously from 29.9-34.0% at 35 DAF to 19.7-24.3% at 56 DAF. At 42 and 49 DAF, the moisture contents were between 27.8% and 24.3%. The 24-25% moisture content may be considered optimum for harvest. Similar results were obtained (6) in Bangladesh. On the other hand, the highest head rice yields were obtained by harvesting at 22-26% moisture content in California, and at 18-22% moisture content in Arkansas (5).

Total milled rice increased from 70.5-71.5% at 35 DAF to 72.0-72.8% at 49 DAF. After that there was a slight decrease gradually from 7.4-10.4% at 35 DAF to 3.4-5.9% at 56 DAF. The chalky kernels make poor the appearance of milled rice. The highest total milled rice and lowest breakage percentage were observed harvesting at 49 DAF in three planting times. Similarly, harvesting between 27 and 39 days after flowering at high moisture content (18-23%) gave maximum head rice recovery in India, harvesting before or after that period resulted in increase of broken grains (3). On the other hand, it was also noted that harvesting between 32 and 42 DAF produced maximum field yield and total and head yield of rice in India (8).

The variance analysis of data showed that there was no interaction between planting and harvesting times for

field yield and total milled rice. However, there were significant interactions for unfilled and partially filled grains at 0.05 level, and for breakage, chalky kernel, and 1000 grain weight at 0.01 level.

According to the average of the data recorded from three planting times (Table 2), it indicated that harvesting time 49 DAF had the highest grain yield, total milled rice and 1000 grain weight, minimum breakage and chalky kernel. Harvesting before or after this time causes decreases or increases in the values of these traits. The lowest average unfilled and partially filled grains recorded at 56 DAF. It had same values at 42 and 49 DAF. The average grain moisture content at harvesting decreased from 31.9% at 35 DAF to 22.8% at 56 DAF. It was 24.9 DAF at 49 DAF.

The present study showed that maximum field and total milled rice, minimum breakage during milling, acceptable moisture content, minimum chalky kernel in milled rice were obtained harvesting at 49 DAF. The early harvesting of paddy causes both quantitative and qualitative losses. Therefore harvesting should be done on time. This time, according to the results of the present study is 49 DAF in the northwestern Turkey. It may be one week earlier in the late plantings.

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