EFFECT OF HARVESTING TIME ON YIELD AND GRAIN SHATTERING OF RAPESEED (*BRASSICA NAPUS* L. CV. OKAPI) UNDER ARAK, IRAN ENVIRONMENT

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Abstract
Rapeseed (*Brassica napus* L.) is one of the important oil crops with a large scale that is sown as a winter crop in Iran. The harvesting time is one of the critical steps in rapeseed seeds production. However, there is very little information regarding harvest time and grain shattering occurrence. The goals of the present study were to identify the effect of harvesting date and time in day and night on rapeseed (cv. Okapi) yield, harvest index, grain shattering rate and its percentage. The field experiment was conducted as split block design in complete randomized block with three replications in 2006-2007 at the Research Farms of Islamic Azad University, Arak, Iran. The harvesting date treatments consisted of three dates (10th and 26th June, and 11th July) and harvesting was taken four times per day and night (6.00am and 12.00pm, 6.00pm and 11.00pm). The results indicate that the grain harvested on 26th June was the most accurate date for rapeseed harvest time in Arak farm's condition. Harvesting on 26th of June and at 6.00pm was the best term for beginning of harvesting. In this term the grain yield was the highest level up to 3600 kg/ha and the grain shattering percentage was the lowest one, 14.0%. Any delay in harvesting from 26th June could result in the decrease of the yield and increase of the total grain loss. Harvesting at 11th of July was the critical date for the grain yield loss for two different reasons, first for increase of the shattering from 3.5% to 6.3% before harvesting and the second for grain shattering during the harvesting process in range from 14.8% to 16.3%.

Keywords: Rapeseed, shattering, harvest date, harvest time

Introduction

Rapeseed (*Brassica napus* L.) is one of the important oil crops with a large scale that is sown as a winter crop in Iran. However, there is very little information regarding harvest time and grain shattering occurrence. Increasing of some oilseeds and more production of rapeseed is one of the most important goals in Iranian farms as a winter crops. In that condition the first stage of rapeseeds growth and development have not any important problems but after the winter and during the fast changing of whether in late of spring to the first of summer, the rape farms contact to many of stresses same heat stress in grain ripening time and grain shattering respectively (Madani et al 2009). The goals of the present study were to identify the effect of harvesting date and time in day and night on rapeseed (cv. Okapi) yield, harvest index, grain shattering rate and its percentage. Combining a ripe crop at higher seed moisture levels will help to reduce combine shattering losses. It is important to then dry the crop for safe storage. Harvesting in the cooler part of the day or at night when the pods are damp with dew can also help (Elaine Moats, 2010).

Material and methods

Arak zone with latitude 34°05'N, longitude 049°42'E, Elevation, 1718 m in general has a relatively cold and dry climate. Its weather is warm and dry in summer, windy and cool in autumn, cold and snowy in winter, and mild in spring. The maximum temperature may rise up to 35 degrees Celsius in summer and may fall to below -25 degrees Celsius in winter. The average rainfall is around 300mm and the annual relative humidity is 50%. The field experiment was conducted as split block design in complete randomized block with three replications in 2006-2007 at the Research Farms of Islamic Azad University, Arak, Iran. The harvesting date treatments were on10th and 26th June, and 11th July 2008

as harvesting dates and harvesting for cut the rapeseed (cv. Okapi) whole plants were based on four times per day and night time 6.00 and 12.00 pm and 6.00, 11.00 pm.

Results and discussion

Seed water content (Table 2) was high at June 10th at all day time by 20%. Shattering rate was least at the same date by 166 to 195 kg/ha for D1T4 interaction and T1, T3, T4 simple effects at physiological maturity stage. The results indicate that the grain was harvested on 26th June showed the most accurate date for rapeseed harvest date in Arak farm's condition. Harvesting on 26th of June and at 6.00pm was the best period for beginning to harvesting start operation. In this term the grain yield was the highest level up to 3600 kg/ha and the grain shattering percentage was the lowest one, 14.0%. Any delay in harvesting from 26th June could result in the decrease of the yield and increase of the total grain loss. Harvesting at 11th of July was the critical date for the grain yield loss for two different reasons, first for increase of the shattering from 3.5% to 6.3% before harvesting and the second for grain shattering during the harvesting process in range from 14.8% to 16.3%. Delay in harvesting from morning to noon time at all sowing date were shown the increase in seed shattering pre and during the harvest operation. Shattering rate in D2 harvest date was more susceptible to cutting operation at afternoon and evening times (fig 1, left). According to figure 1 (right), for late harvest time (July 11th) the trend of pre-harvest shattering curve was grown from noon to evening time. There are two important results for grain shattering happen. The first, is the importance of prefer better harvest time to reduce of grain shattering specially when the harvest date was run from day time to evening time. Second is depended to cutting operation time on farms. That is very important for attention to time for harvest, that noon time harvesting is the very first cause for increase of total seed shattering rate.

Table1. Effect of harvesting date and time on rapeseed shattering index

SOV	DF	MS					
		Seed yield	HI	Seed water content	Shattering rate	Shattering percentage	preharvest Shattering
Replication	2	1944165	412.88	20	932.30	5.64	1.39
Harvesting date(D1)	2	2217648*	748**	78 *	4269.23 **	21.08*	241.02**
Error a	4	30951	38	7	4052.74	3.04	0.94
Harvesting time(D2)	3	50329*	19 ns	3 ns	200.79*	0.39ns	0.66ns
Error b	6	10167	17	2	1674.76	1.30	0.28
Interaction	6	66739*	32 ns	0.96 ns	2062.49 *	3.31*	0.59ns
Error	12	21285	17	4	1135.85	1.78	0.67
CV%		15	12	10	16.9	8.44	17.02

*, ** Significant at 5 and 1% probability levels, respectively

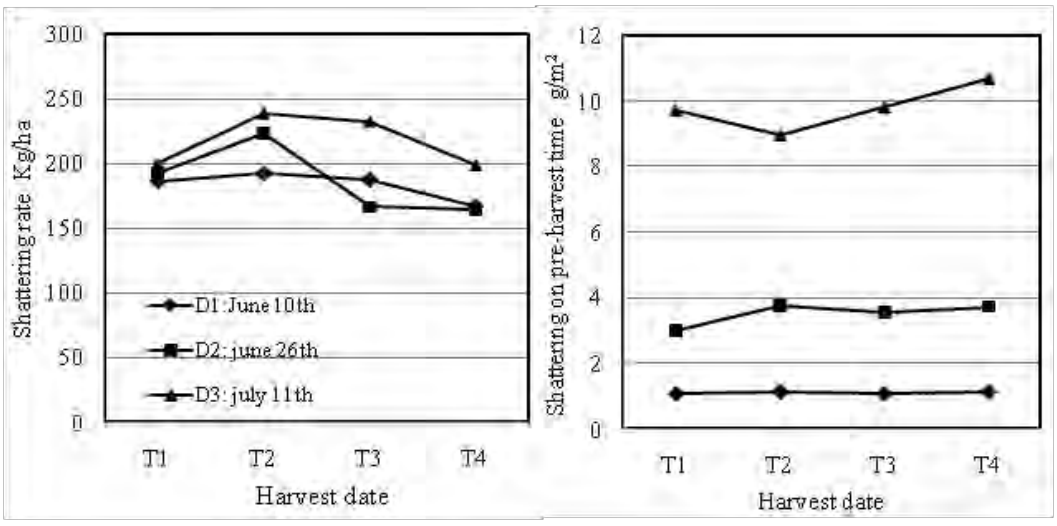

Fig 1: Effect of harvesting date and time on shattering rate (left) and shattering pre-harvest time (right).

Table2. Mean comparison of harvesting date and time treatment levels

Treatments	Seed Yield Kg/ha	HI %	Seed water content %	Shattering rate Kg/ha	Shattering percentage%	Shattering on pre-harvest time g/m^2
Harvest date						
D1: June 10th	2595.16 c	36.78 b	20.29a	200.27 b	13.798 c	1.100 c
D2:June 26th	3454.75 a	50.69 a	18.46 b	180.08 c	14.790 b	3.517 b
D3:July 11	3009.16 b	50.21 a	15.26 c	217.77 a	16.287 a	9.783 a
Harvest time						
T1: 06 am	3087.77 a	46.68 a	19.22 a	195.73 b	15.811 b	4.589 a
T2: 12 am	2920.22 b	43.68 a	16.94 a	200.21 a	16.357 a	4.622 a
T3: 06 pm	3065.00 a	46.74 a	18.50 a	195.82 b	15.549 b	4.811 a
T4: 11 pm	3005.77 ab	46.49 a	18.34 a	195.74 b	15.750 b	5.178 a
D1 ×T1	2666.66 b	38.53 c	20.00 a	186.76 bc	16.583 b	1.067c
D1 × T2	2550.00 b	36.27 c	20.00 a	192.66 bc	16.587 b	1.133c
D1 × T3	2593.33 b	36.03 c	20.33 a	187.73 bc	16.277 b	1.067 c
D1 × T4	2570.66 b	36.30 c	20.83 a	166.9 c	16.747 b	1.133 c
D2 ×T1	3353.33 ab	48.17 ab	18.33 ab	193.50 bc	16.717 b	3.000 b
D2 ×T2	3260.66 ab	46.07 b	17.00 b	223.93 ab	18.380 a	3.767 b
D2 ×T3	3606.66 a	52.77 a	16.33 b	166.73 c	16.547 b	3.567 b
D2 ×T4	3598.33 a	55.77 a	18.16 ab	164.66 c	16.517 b	3.733 b
D3 ×T1	3243.33 ab	53.33 a	14.33 c	200.13 b	16.133 b	9.700 a
D3 ×T2	2950.00 b	48.70 ab	14.83 c	239.33 a	19.203 a	8.967 a
D3 ×T3	2995.00 b	51.43 a	15.83 c	233.00 a	18.823 a	9.800 a
D3 ×T4	2848.33 b	47.40 ab	16.03 b	198.63 b	17.987 ab	10.667 a

Means with the same letters are significantly difference at P (<0.05).

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