ZESZYTY PROBLEMOWE POSTĘPÓW NAUK ROLNICZYCH 1995 z. 427, 65-69

INFLUENCE OF VARIOUS TERMS OF HARVEST ON QUALITY OF RAPE SEEDS*

J. Tys

Institute of Agrophysics, Polish Academy of Sciences, Doświadczalna 4, 20-236 Lublin, P.O. Box 121, Poland

A b s t r a c t. An estimation of the technological value of rape seeds depending on different harvest methods was carried out. Seeds of different varieties from field experiments, which included single- and two-stage harvesting and differentiation in plant maturity, were also analysed. Seed samples were taken from every experiment combination. They were chemically analysed in order to determine the content of fat and chlorophyll, and the acid and peroxide numbers. Additionally, the mass of 1000 kernels was measured. The results obtained pointed out to a higher content of fat in seeds from the single-stage harvesting and the lower content of chlorophyll. Other chemical parameters of the seeds were insignificant. Analysing the single-stage harvesting, it should be stated that this method of rape harvest, before full maturity, gives seeds of worse technological parameters and of poor quality (low mass of 1000 seeds). Likewise with two-stage harvesting - too early harvest, lower technological value and poor development of seeds.

K e y w o r d s: rape seeds, harvest technology, seed quality

INTRODUCTION

Silique cracking and seed shedding during the maturation and harvest period, rapid maturation of plants in the final phase of development, and lack of clear methods of estimating technical and full maturity, cause that farmers, even ones with great experience, cannot estimate the proper moment for beginning rape harvest. Single-stage harvesting should begin in full maturity, while two-stage harvesting should begin during technical maturity. Precise estimation of these phases of maturity is difficult and different authors propose various ways to perform it [1-4,6,8]. Therefore, rape harvest is often begun too early, because farmers are afraid of high seed losses in case of late harvesting, no matter whether it is single- or two-stage harvest. Too early single-stage harvesting or too early plant cutting to swaths (in two-stage harvesting), however, also causes lots of trouble with worse quality of the seeds. Picking immature, unevenly mature, or damaged seeds decreases the industrial value of the raw material, evidenced by decreased fat efficiency and lower quality. Immature, heated, and moulded seeds, often stored together with healthy and dry ones, cause the quality of the whole batch to decrease [5].

Obtaining high seed yields of favourable traits, required for raw material to be processed by the fat industry is, therefore, possible only in the case where a technology including the proper phase of plant maturity, appropriate for the chosen harvest technology, is used. The choice of one out of the two harvest technologies depending on plantation condition, machines available, or, most commonly,

*This work was supported by the State Committee for Scientific Research, Poland, under grant No. 5 0027 91 01

on the customs and habits of the particular region of the country, does not guarantee maximum limitation of losses nor getting seeds of high value - with low level of damage [9]. An important element is to prepare the machines properly (regulation, adaptation), according to the physical condition of the plant canopy - moisture, maturity, variety, plant density, height, inclination, weeds, etc. [7,9].

The determination of the influence of the harvest technology used, considering the various phases of plant maturity, on the technological value of seeds has been considered the major aim of this paper.

METHODS

The evaluation of the technological value of seeds has been made on the basis of:
- fat content - FC (%),
- acid number - AN (mg KOH/g),
- peroxide value - PV (L. Lea),
- chlorophyll content - CHC (ppm).

Chemical analyses were performed according to the standards required by the Institute of Plant Breeding and Acclimatization (IHAR) Poznań and by the Agrotechnology Centre of the Polish Academy of Sciences, Olsztyn.

The evaluation of the technological value of seeds was performed by harvesting rape with various methods:

Single-stage harvesting - using a BIZON harvester with standard equipment. The following terms of harvest were applied:
- very early (5 days before full maturity),
- early (3 days before full maturity),
- optimal (full maturity), using beater drum rotation of: 600, 800, and 1000 r.p.m., and threshing slot at the outlet of 16 mm. Seeds harvested by hands were the control,
- delayed (5 days after full maturity),
- very delayed (8 days after full maturity).

Two-stage harvesting - cutting to swaths was made with a FORSCHRIT swath mower. Four terms of cutting to swaths were applied:
- very early (5 days before technical maturity),
- early (3 days before technical maturity),
- optimal (technical maturity),
- delayed (3 days after technical maturity).

Swaths cut in different maturity phases of plants were then picked with the harvester using the so-called 'double cut' method. Picking the swaths with the harvester was performed in 3 terms:
- early (swath was threshed 5 days after cutting),
- optimal (swath was threshed 8 days after cutting),
- delayed (swath was threshed 14 days after cutting).

From every combination of the experiment 50 kg of seeds were taken, from which a part has been given to chemical analysis.

RESULTS

On the basis of the results obtained (Tables 1-4), it can be stated that both the varieties and the years considerably influenced the chemical composition of seeds. It is interesting that in the years in which the seeds had the highest content of fat they did not show optimal parameters of the investigated oil quality indices, i.e., acid number, peroxide value and chlorophyll content. In 1989 and

Table 1. Single-stage harvesting - influence of harvest time, beater drum rotation rate, and analysis time on technological value of seeds of the Ceres variety of rape (1989)

Parameter	Harvest time				
	very early (- 5 days)	early (- 3 days)	optimal (0 days)	delayed (+ 5 days)	very delayed (+ 8 days)
Mass of 1000 seeds (g)	3.8	4.0	4.3	4.2	4.2
Fat content (%)	49.7	50.1	51.3	51.7	51.8
Chlorophyll content (mg/kg)	31	21	15	16	17
Acid number (mg KOH/g)	3.4	1.6	1.3	1.3	1.3
Peroxide value (L. Lea)	8.2	7.8	3.1	2.0	2.0

Table 2. Quality features of rape seeds of various varieties and of differentiated maturity (1992)

Variety	Maturity	Mass of 1000 seeds (g)	Fat content (%)	Acid number (mg KOH/g)	Peroxide value (L. Lea)	Chlorophyll content (mg/kg)
Ceres	very early	3.8	41.3	1.63	0.62	23.4
	early	4.0	43.2	0.60	0.60	8.2
	optimal	4.3	43.9	0.43	0.30	2.0
	delayed	4.2	43.3	0.41	0.22	3.9
Liporta	very early	3.8	42.6	2.01	0.63	14.6
	early	4.1	42.8	1.52	0.53	9.2
	optimal	4.3	44.2	0.61	0.38	8.4
	delayed	4.6	42.6	0.41	0.24	6.8
Mar	very early	4.2	43.6	1.58	0.65	32.2
	early	4.4	44.1	0.92	0.27	12.4
	optimal	4.6	45.5	0.57	0.17	6.6
	delayed	4.4	44.9	0.41	0.08	5.2
Bolko	very early	4.2	42.2	0.53	0.35	24.2
	early	4.3	43.6	0.45	0.28	16.1
	optimal	4.3	44.8	0.32	0.11	12.1
	delayed	4.5	44.4	0.40	0.13	10.9

Table 3. Two-stage harvesting - influence of time cutting to swaths, time of gathering from swaths, and time of analysis on the technological value of seeds of the Ceres variety of rape (1989)

Parameter	Cutting time											
	very early (- 5 days)			early (- 3 days)			optimal (0 days)			delayed (+ 3 days)		
	A	B	C	A	B	C	A	B	C	A	B	C
Mass of 1000 seeds (g)	4.7	4.8	4.8	4.7	4.8	4.7	4.7	4.9	5.0	4.9	5.1	5.2
Fat content (%)	47.3	48.6	47.7	47.9	47.8	48.2	48.8	49.1	50.1	48.8	49.9	50.1
Chlorophyll content (mg/kg)	55	52	32	47	40	32	25	20	12	25	12	9
Acid number (mg KOH/g)	2.9	2.3	1.9	1.0	0.8	0.8	1.3	1.5	1.0	1.6	1.5	1.6
Peroxide value (L. Lea)	9.6	8.3	6.5	6.5	6.0	4.4	5.0	6.1	3.9	8.7	5.5	4.1

A - swath threshed 5 days after cutting to swaths; B - swath threshed 8 days after cutting to swaths; C - swath threshed 14 days after cutting to swaths

Table 4. Influence of rape harvesting technologyon the technological value of seeds

Variety	Year	Mass of 1000 seeds (g)		Fat content (%)		Chlorophyll content (mg/kg)		Acid number (mg KOH/g)		Peroxide value (L. Lea)	
		I	II	I	II	I	II	I	II	I	II
Jupiter	1988	5.5	5.3	48.2	47.2	4	20	1.6	1.3	1.6	4.1
Ceres	1989	4.9	4.8	51.9	49.1	15	25	1.3	1.5	2.3	6.1
Ceres	1990	5.0	4.9	51.5	49.5	17	39	0.6	0.5	0.6	6.9
Ceres	1991	4.3	4.4	46.4	46.9	12	30	1.9	1.7	1.9	2.9
Ceres	1992	4.3	4.2	43.1	43.2	4	19	0.8	0.5	0.9	0.5
Liporta	1992	4.8	4.4	44.9	44.2	5	8	0.8	0.6	0.2	0.4
Mar	1992	4.6	4.8	45.0	45.5	7	7	0.3	0.6	0.6	0.6
Bolko	1992	4.3	4.0	42.8	43.5	4	15	0.9	0.4	0.7	0.9

I - single-stage, II - two-stage.

1990, when fat content was over 50 %, all the above parameters were worse, irrespective of the harvesting technology. Whereas in 1992, when the seeds contained much less fat (42-45 %), the investigated oil quality indices had very good parameters.

The terms of harvest had a great influence on the fat content, as well as on the values of acid number, peroxide value, and particularly on the chlorophyll content. The seeds from the very early harvest, despite the harvest technology, had a very high chlorophyll content (23-55 mg/kg). Also, the mass of 1000 seeds collected in the very early harvest was much lower (by about 0.4 g) than the mass of seeds from the optimal harvest time. It is characteristic that the mass of 1000 seeds gathered in the delayed term was a little, but visibly lower (a difference of 0.1-0.2 g) than in seeds from the optimal harvest time.

Analysing the combinations studied in two-stage harvesting, it should be stated that if the plants were cut too early, then even a long period of keeping them in swaths would not provide a high fat content nor positive parameters of acid number and peroxide value. The chlorophyll content in those seeds was always high. It means that plants separated from their root systems are not able to fill the seeds optimally. It should also be stressed that because of the causes described in the introduction, a lot of farmers cut rape to swaths too early.

Comparing the single- and two-stage harvesting it can be stated that in the case when the technological regime of both of them is kept, the seeds harvested have similar chemical composition and mass of 1000 seeds. Only the content of chlorophyll in some cases may be higher in the seeds from the two-stage harvesting.

CONCLUSIONS

1. It was found that too early cutting of rape ('from a standing crop' or to swaths) negatively influences not only the crop yield (lower mass of 1000 seeds) but also the quality of obtained raw product (worse parameters of quality discriminants of oil-fat content, acid number, peroxide value, and content of chlorophyll).

2. In the two-stage harvesting even longer period of keeping the plants in swaths is not able to get rid of the quality losses (lower mass of 1000 seeds) and quality losses (worse parameters mentioned above) caused by cutting the rape too early.

3. Keeping the technological regime which is required in the single- and two-stage harvesting causes that both of the technologies of rape harvest allow us to obtain raw material of similar - high quality, for the oil industry.

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WPŁYW RÓŻNYCH TERMINÓW ZBIORU NA JAKOŚĆ NASION RZEPAKU

Dokonano oceny wartości technologicznej nasion rzepaku w zależności od stosowanych sposobów zbioru. Analizie poddano nasiona różnych odmian pochodzących z doświadczeń polowych, które uwzględniały zbiór jedno- i dwuetapowy oraz zróżnicowane fazy dojrzałości roślin. Z każdej kombinacji doświadczenia pobrano próbki nasion, które następnie poddano analizie chemicznej w celu określenia: zawartości tłuszczu, chlorofilu, określenia liczby kwasowej

i nadtlenkowej. Dodatkowo określono masę 1000 nasion. Uzyskane wyniki wskazują na wyższą zawartość tłuszczu w nasionach pochodzących ze zbioru jednoetapowego jak również niższą zawartość chlorofilu. Pozostałe parametry chemiczne nasion były nieistotne. Analizując natomiast zbiór jednoetapowy należy stwierdzić, że koszenie rzepaku tą metodą w terminach przyśpieszonych (przed pełną dojrzałością) pociąga za sobą otrzymywanie nasion o znacznie gorszych parametrach technologicznych jak również mniej dorodnych (mała masa 1000 nasion). Podobnie przy zbiorze dwuetapowym zbyt wczesne koszenie na pokosy daje plon nasion o mniejszej wartości technologicznej i gorszym wykształceniu nasion (małe wartości MTZ).

S ł o w a k l u c z o w e: rzepak, nasiona, technologie zbioru, jakość nasion.